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SUMMARY

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Preface to Volume Eleven

PASTEUR's first scientific achievement was his discovery of the true nature of the paratartaric (or racemic) acid. This substance had been obtained accidentally in 1819 or 1820 by an Alsatian manufacturer called KESTNER. Later it was shown to be equivalent to the tartaric acid which SCHEELE had extracted as early as 1769 from the « tartar » deposited in wine casks — entirely equivalent except in one respect. If polarized light was caused to pass through a solution of tartaric acid, the plane of polarization was turned; on the contrary the paratartaric acid was optically neutral. This had baffled BIOT and GAY-LUSSAC, and, as late as 1844, MITSCHERLICH had declared himself unable to account for this strange dissimilarity. Young PASTEUR kept pondering upon this for many years, in the meanwhile studying crystallography, and in the spring of 1848 had the genius to link the facts whose combination would explain this mystery. He crystallized paratartaric salts, and observing the crystals under the microscope, discovered that they were of two types, of which one was like the image of the other in a mirror. If these two types of crystals were isolated, and each was again dissolved, one obtained two solutions, both of which were optically active, but one of which turned the plane of polarization to the right and the other to the left. The paratartaric acid was optically inactive, simply because it contained equal amounts of dextrogyre and laevogyre crystals, which neutralized each other.

This remarkable discovery was brought to the knowledge of BIOT, who was then seventy four years old. He expressed interest, but with some scepticism which his age and experience and PASTEUR's youth justified. The young chemist offered to demonstrate the matter to him, and this was done with considerable care on the part of both men. PASTEUR was anxious to give a good demonstration; BIOT was equally anxious not to be fooled.

Paratartaric crystals having been obtained, PASTEUR showed

that they were of two kinds, right and left. « Do you really maintain, » said BIOT, « that one kind of crystals will turn the plane of polarization to the right, and that the other kind will turn it to the left ? »

« Yes, » answered PASTEUR.

« Well, leave me alone — I'll do the rest. »

After having himself prepared the two solutions, BIOT recalled PASTEUR, and made the final verification in his presence. Everything happened as PASTEUR had foretold. Thereupon the old man took him by the arm and exclaimed : « My dear child, I have loved science so much all my life that this makes my heart beat. »

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This story is not new, but it cannot be told too often. PASTEUR's discovery proved to be the beginning of a new branch of chemistry of enormous importance, but when the old man said, « This makes my heart beat, » he was not thinking of the future. Neither of them was then thinking of it but only of the particle of truth which it had been their privilege to see revealed, and which was infinitely precious to them, irrespective of its consequences. This illustrates the true spirit of science, a spirit which has been hovering over mankind since the very dawn of civilization, but which relatively few men have grasped and fewer still, nourished. It illustrates the Spirit of Man and it is with the history of that very spirit that we are mainly concerned. It is that history — the history of art, the history of science, the history of religion — that gives a meaning to our life. Our lives are interesting (that is, if they are interesting at all) because they continue such traditions, however humbly; for otherwise what would the continuation of our flesh and bones matter ? It is the spirit alone that signifies; the rest is like a mouldiness that spreads wherever it can, like a blind spawning in the ocean, like the other forces of nature, thoughtless, heartless, without conscience.

It is the spirit alone that matters. This is obvious enough, but we forget it all the time. And even the very servants of the spirit have to be reminded of it. For it takes energy to stand up, and we all get tired; we are often rejected and sometimes discouraged. There are hours when our light shines like a bright

star in the night; but others when it is dimmed. We have been weak and we shall be weak again, but these times of failure do not represent our true selves. We are ourselves, not when we are sick and down, but when we are standing up and fighting all that is evil, commonplace, conventional or snobbish, all that is spiritless, fighting that immeasurable dead weight which would drag us down again; we are ourselves when we are standing up and loving all that is pure and as disentangled as possible from the things that die. We are at our best when we continue the highest traditions of mankind by the creation of beauty or the unveiling of truth. It is well to venerate such traditions and to have a grateful heart; it is better to continue them — to go forward.

To go forward ! What does this mean ? It does not mean only what it says. In my mind, it means a little more, for it implies consciousness. My hero is not simply the pioneer, the victorious inventor who blazes new paths, or makes two blades of grass grow where only one grew before. My hero goes forward but, from time to time, looks backward; he makes sure that he thoroughly understands the traditions which he is trying to continue, he makes sure that he is leading his fellow men and not misleading them. He is not simply a pioneer, but also a poet and an artist; most pioneers are not. To increase our power over nature, our wealth, our comfort, to lengthen our lives, is meritorious but secondary. The truly noble achievement is to add beauty or joy to the world, to deepen our disinterested understanding of it or of ourselves, to intensify our communion with it. All that strengthens the spirit of man is great; all that weakens it is mean. The New Humanist looks backward for the peace of his conscience and the joy of his heart, but he never stops on the road; he goes forward. How could we really appreciate the traditions which give our lives their sacred meaning, if we did not continue them, or at least if we did not try to do so ? The past is full of beauty, but less so than the future. As long as we are really alive, our first allegiance is to the future; we shall belong to the past only when we are dead.

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This then is the standard of *Isis* : pure science, pure scholarship.

Not more knowledge, — this is not so much our task, — but a purer knowledge, and one that shall be less hard, less sharp — and mellowed by charity. Every author or editor writes for a definite public with a definite purpose. He may write to make children laugh or women blush, or more often, to make people pay; or else, he may write to arouse their sense of justice, to delight their hearts, to quicken their thoughts, to tell the truth as he sees it. Which is the public of *Isis* ? It is not easy to say, for the historian of science is still a very rare person; the number of professionals is still exceedingly small; in fact, it can be counted upon one's fingers. Our readers do not yet form a tangible and homogeneous group. However, we have already explained more than once what the Editor of *Isis* was driving at, and we can readily say whom he is writing for.

We are writing mainly for two young men. One of them is a physicist. He is very ambitious but his thoughts are not of money or power; his ambition is to add something to our knowledge of the world, to our objective and common knowledge of it — to add a paragraph or a footnote in one of our scientific textbooks. That is *his* task, the source of his activity, but he is not lobsided. Indeed he is anxious to understand the relation of his effort to the efforts of other men of science, past and present. His mind is engrossed by the subject of his investigations, but his heart is hungry. He wishes to embrace the unity of science, to understand its genesis and evolution, to appreciate the convergent endeavors of artists, reformers, dreamers and holy men. The essential goodness of man reveals itself in many ways. Could these be unrelated ? Our young physicist feels all this and besides he does not imagine that he knows everything or that everything can be known. Science does not so much decrease the mystery of the universe as displace and localize it; it divides the light from the darkness. As the field of our knowledge widens, the boundary line which separates it from ignorance and mystery does not shorten, but on the contrary lengthens. Men of science are not afraid of mystery. It represents to them the thing to be conquered; the purpose and the romance of life; the eternal source of newness and youth.

This young scientist asks himself many questions which the technical journals do not answer; his excursions into the border-

lands of knowledge, along the uncertain frontiers of science, arouse in his mind many doubts and longings. He reads *Isis* because he hopes to find in it the answer to his questions, the solution of his doubts, the gratification of these extraordinary and irrepressible longings. *Isis* is his literary journal, his romantic friend. Sometimes he finds a valuable answer in it, more often not, but he remains faithful, for however meager the results, he is aware that he can find what he needs more readily in *Isis* than anywhere else. If he does not find more, it is not so much the fault of *Isis*, but because what he is looking for is something very rare and precious.

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The other young man is a scholar. He is, or aims to be, a complete mediaevalist. He is trying hard to understand the development of mediaeval thought in Europe, to grasp this development in all of its ramifications and also in its wholeness. He is not studying a solitary stream of thought, let us say, the Latin or the Arabic, but endeavors to understand as much as possible every stream and to evidence their reciprocal relations. Some thoughts were expressed in Latin, others in Greek, Arabic, or Hebrew, or in various vernaculars. How much was each people influenced by the others; how much, in its turn, did it influence the others ? His ambition is to draw the map, so to say, of all these intellectual streams, to show the obstacles which they had to turn or to overcome, even as real rivers turn around the hills or dig valleys across them. Of necessity he lives far more in the past than does the young physicist. Yet he realizes that the past cannot satisfy all the longings of his heart. He is living *now* in a world that moves faster and faster. He is not willing to be abandoned, he must advance too and understand the general drift. He also realizes that to appreciate the past one must appreciate the present as deeply as possible; for the past was once the present, the fresh creation of living men; it was once just as alive and reckless as the present is or seems to be. He would read scientific journals, but most of these are too technical and discouraging, and they fail to answer his questions or to still his doubts. He reads *Isis*, as much of it as he can and cares to, because he is

aware that this is the best way of remaining in touch with the living world of science and of feeling a little at home in it. *Isis* is his scientific adviser. It answers only a few of his questions, yet he remains faithful to it, because he knows the difficulties of his quest and that he has a better chance of finding what he needs in *Isis* than anywhere else.

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These two young men are very different, yet they have an air of resemblance. They have come from opposite points of the intellectual horizon, but at the end of their long journeys, they find themselves surprisingly near. They symbolize very well the composite public of *Isis* : scientists nourishing historical interests and loving to look backward once in a while; scholars who want to know something of that all-embracing and esoteric world of science which is surrounding them more and more closely. Indeed, the New Humanism is a double renaissance : a scientific renaissance for men of letters, a literary and artistic one for men of science.

The Editor's problem is how to satisfy equally well these two young men, who are alike in a few respects, but so utterly different in every other. This is very difficult but not impossible, and at any rate worth trying. It must and will be done. His success depends partly upon his own effort, largely upon the spontaneous efforts of his readers. How far is each of them willing to go in order to meet the others ? To be candid, the ideal public of *Isis* does not yet exist in any tangible size, but it is continually growing, and others — later, much later — will reap what we are sowing. That is all right. The only terrible thing would be if nobody reaped; but no matter how late the husbandmen come, the harvest will be ready.

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Pure science, pure scholarship. No compromise is possible here. Such compromise may be necessary and useful somewhere else, but here — in *Isis* — it would be a sort of betrayal. As this matter is often misunderstood, it is well to explain briefly what it implies and what it does not imply. It implies austerity, but it does not

imply any feeling of superiority or pride, anything aristocratic or contemptuous.

One hesitates to speak of purity or sanctity, because every time one does so one gives hypocrites a new opportunity. Everything authentic can be and will be counterfeited, but surely this cannot mean that one should never express the deepest aspirations of one's heart?

Pure knowledge is not reserved for a priviliged group any more than charity or grace. The number of people who appreciate knowledge in an entirely disinterested way may be as small as that of the pure artists or of the saints, but there is no telling beforehand where they are. Genius and sainthood may be hereditary — every human quality is, to some extent — but they are not transmitted as rigidly as wealth or titles. The heir of a duke is a duke, the heir of Cresus is wealthy, but the heir of a man of genius is not necessarily a man of genius. He will not be counted such unless he prove himself to be one. Pure knowledge may be found wherever there are pure hearts, that is, everywhere in general and nowhere in particular.

Thus our appeal is not directed to any predetermined group of men, but to all men. The purity of one's knowledge is not a function of its size nor even of its depth. Any man will readily understand our message whose knowledge, however limited, is honest, and who does not boast or bluff. The fact that he will not appreciate everything which is printed in *Isis* hardly matters, for the essential is the message itself.

We insist above all upon austerity. The bane of our studies is that too many men of science approach them in a spirit of dilettantism. They may be extremely careful and austere with regard to their own work, but as soon as they touch history they expect to be entertained. Now this is preposterous. The history of science is like any other subject; it has its high spots, its dramatic moments, its romantic interludes, but these cannot be separated from the duller background without loss or danger. Men of science must learn that here as elsewhere it is best to leave things in their original setting. Those who want only the cream of history will never benefit by it, nay, they will hardly appreciate it when they get it; like people trying to feed on dainties alone, they will be surfeited before being nourished.

Austerity is thus only another aspect of unity. It is the wish to see things as they are in their natural relationships with other things, pleasant or dull; the wish to see wholes rather than fragments. It is a reaction against the natural tendency to pluck the flowers only and make anthologies. This healthy reaction is not the privilege of any definite group of people, of any obvious aristocracy. Any man who knows his own intellectual background well, and enjoys it quietly, and who will not allow himself to be unduly influenced by loud speakers, will readily understand this. Any man, who living a humble life, finds it possible to tear away from the newspapers and magazines and read slowly a good book, or who has enough stamina to resist the cheap seduction of the movies in order to attend a good play or listen to good music, or simply to walk wistfully in his garden, — any such man will help to restore the true values of life and to create a better world. Any such man will instinctively appreciate our effort, even if there be much in *Isis* which does not interest him.

The pure in heart who work honestly and unobtrusively, without snobbishness, without bluff, who perhaps long for fame yet know deep in themselves that fame might hurt them, — these are our most beloved public. For is it not one of the main duties of the historian of science, to reëstablish some justice in the appreciation of men's works ? It is almost impossible for contemporaries to be unprejudiced, and their judgments are more often erroneous than not; it is the historian's sacred task to correct them, as much as possible. On the other hand, the genuine man of science learns to appreciate modern judgments in the light of history. Thus if he be made of the real stuff, he will yearn not so much for the applause of his contemporaries, as for the dispassionate and considered judgments of posterity. A straightforward recognition of his efforts is enough to satisfy him, and even that, he realizes, is not essential. The only thing that matters is to do one's best.

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To illustrate my thoughts in another way, let us go together to the Civic Repertory Theatre (the old Fourteenth Street Theatre) in New York, to see EVA LE GALLIENNE and her company. Let

us go on a good night, for this admirable actress is not always equally successful in her choice of plays, and some of them are good, and others not so good. Let us go, for instance, when she interprets the *Master Builder* or *Three Sisters*. Her art is austere; nothing unnecessary, no trimmings. The austerity of art is not essentially different from the austerity of science, and her gospel is the same as ours. This helps to explain that there is nothing supercilious in our endeavor, for her attitude proves it very plainly. EVA LE GALLIENNE realized that to succeed at all in accomplishing her ideal, or a part of it, the first requisite was to cut away from the theatres of Broadway. In the vain attempt to satisfy the caprices of audiences, the majority of which is extremely sophisticated without being educated, she would have jeopardized her own standards. An actress trying night after night to earn the plaudits of such audiences is led gradually to exchange her purest ambitions for worthless things, she is bound to become a sort of prostitute — not a venial prostitute, who does nothing worse than to sell her poor little body, but one infinitely more miserable, who hawks her very soul.

There are all sorts of men and women, and there must be, to serve them, many types of education. But people who are sophisticated are beyond salvation, for their standards are false. As they are headed in the wrong direction, the more they progress, the worse they become. That is what EVA LE GALLIENNE understood and that is why she broke off from the Broadway crowds. There is no harm in being uneducated, but sophisticated snobs, male or female, are hopeless. An uneducated man or woman may be as pure in heart as the most educated; it is a matter of potentialities, which as long as they have not been smothered by false ideals, can always develop. It is for the pure in heart, whether educated or not, that EVA LE GALLIENNE is working and it is to them that she is giving every ounce of her energy, her very life. And we would say, it is for them, though in a very different way, that we too are working. The New Humanism is not a new kind of sophistication, but a higher education of the most austere and uncompromising type. Let other people lower their standards, we will keep ours aloft, high above the noisy and vulgar crowds, yet within reach of every pure heart.

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We are just as anxious to go forward as the most modern of the moderns; we do not mean to resist progress, but to resist extravagance and conceit. Nor do we mistake aimless motion for progress. We go ahead quietly, looking backward quite often for the joy of our eyes and the peace of our heart, and to express our gratitude to the pioneers of old. O Pioneers ! Perhaps we are pioneers too, but not more so than you were. We advance slowly and steadily like those experienced mountaineers who let the fools hurry at the beginning of the trail and beat them regularly in the end.

The great secret of art is to choose and to simplify. This is also the secret of science — simplification and unity. There can be nothing but chaos and confusion without them. And it is also the secret of happiness, to be content with little and forget one's self in it; not to want, but to make the best of everything. The Greeks had seen this ages ago : *μηδὲν ἄγαν*. Nothing superfluous. This is indeed the quintessence of pure art, of pure science, of happiness.

Cambridge, Massachusetts GEORGE SARTON.
April 5, 1928.

Des Johannes Philoponos Schrift über das Astrolab

EINLEITUNG.

Die folgende Uebersetzung ist angefertigt nach dem einzig vorhandenen Druck, den H. HASE im *Rheinischen Museum*, Bd. VI, 1839, veröffentlicht hat. HASE benutzte 3 Ms. der Bibliothèque Nationale in Paris, von denen das älteste und beste aus dem XIV Jahrhundert stammt (bei HASE steht XVI. Jahrhundert, wohl ein Druckfehler). Ausser diesen dreien besitzt dieselbe Bibliothek noch 12 andere Ms. derselben Arbeit. Das Studium dieser Ms. veranlasste PAUL TANNERY zu seinen *Notes critiques sur le traité de l'Astrolabe de* PHILOPON (1). Diese Korekturen sind in meiner Uebersetzung berücksichtigt worden. In dem nicht veröffentlichten Nachlass TANNERYS fand sich auch eine französiche Uebersetzung und ein Aufsatz über das Werk (2).

PHILOPONOS lebte im Anfange des VI. Jahrhunderts in Alexandrien. Er ist oft verwechselt worden mit JOANNES ALEXANDRINUS Grammatikus und Medikus der um 640 lebte, so von F. NAU in seiner Arbeit über SÊBÔKHT.

Die vorliegende Schrift ist die älteste über das Astrolab, die uns aus dem Altertum erhalten geblieben ist. Ihre grosse Bedeutung liegt darin, dass wir aus ihr erkennen, dass das Astrolab seit PTOLEMAIOS stets bei den griechischen Astronomen in Gebrauch gewesen ist, und dass es zur Zeit des PHILOPONOS ein bekanntes Instrument war. PHILOPONOS gibt nämlich zu seiner Schrift keine Figur, setzt vielmehr voraus, dass seine Leser das Instrument in Händen haben.

Das Astrolab war theoretisch begründet durch PTOLEMAIOS in seinem *Planisphaerium*, es ist aber anzunehmen, dass er auch

(1) *Mém. scient.*, IV, p. 243-260.
(2) G. SARTON, *Introduction*, I, p. 422.

über das Astrolab geschrieben hat, da PHILOPONOS an einer Stelle den Grund angibt, der den PTOLEMAIOS veranlasst habe, die Stundenlinien auf die Nachtseite zu verlegen. Im *Planisphaerium* kommen die Parallelen zum Horizont nicht zur Darstellung. Freilich ergibt sich diese aus der Konstruction der Parallelen zur Ekliptik, die ihrerseits im Astrolab fehlen. Im *Almagest* ist das ebene Astrolab nicht genannt, sondern die Armillarsphaere trägt dort den Namen Astrolab. Dagegen empfiehlt PTOLEMAIOS im *Tetrabiblos* (3) das Astrolab als einzig sicheres Instrument zur Bestimmung der Geburtsstunde. Auch in der Folgezeit bis ins XVIII Jahrhundert wurde das Astrolab wesentlich für astrologische Zwecke benutzt. Für wissentschaftliche Beobachtungen ist es nicht geeignet, wenn man von der Zeitbestimmung absieht.

Es tritt nun die Frage an uns heran : Ist PTOLEMAIOS der Erfinder des Astrolabs? Zwei Gründe sprechen dagegen. NAU hat die Arbeit des SEVERUS SÊBÔKHT aus der Mitte des VII Jahrhunderts in Syrischem Text und in französischer Uebersetzung herausgegeben (4). In dieser Arbeit unterscheidet der Verfasser den Philosophen, der das Astrolab gemacht hat von dem Astronomen PTOLEMAIOS. Wichtig ist besonders die Stelle, an der es sich um die fünf Zonen am Himmel handelt. SEVERUS sagt zuerst, man finde als Grenze der immersichtbaren, arktischen Zone mit Hilfe des Astrolabs im vierten Klima den 36. Grad vom Nordpol, die tropische Sommerzone habe die Breite von 30. Grad, die aequatoriale Zone 48 Grad, die tropische Winterzone 30. Grad und die antarktische 36 Grad. Er fährt fort, es gibt noch eine andere Teilung, die der Philosoph gemacht hat, sie hat dieselben Gradzahlen. Drittens gibt es noch eine Einteilung, die durch den Astronomen PTOLEMAIOS gemacht wurde, arktische Zone 36 Grad 9 Min., tropische Sommerzone 30 Grad, aequatoriale Zone 23 Grad 51 Min. nördlich und südlich des Aequators. Die erste Einteilung ist richtig für das vierte Klima, in dem SEVERUS lebte, in Qen neshre am oberen Euphrat. Die zweite ist die seit HIPPARCH allgemein für die ganze Griechische Welt angenommene (5), es liegt ihr die Breite von Rhodos, 36 Grad

(3) III, cap. 2.
(4) *Journal Asiatique*, IX S., t. 13, 1899,
(5) GEMINOS, *Εἰσαγωγή*, cap. V, 48.

zu Grunde. Bei der dritten ist die Ekliptikschiefe 23 Grad 51 Min. des PTOLEMAIOS eingeführt. Dass aber PTOLEMAIOS die arktische Zone um 9 Minuten vergrössert habe, klingt ganz unglaublich. Für seine Rechnungen im *Planisphaerium* benutzt er den schon von ERATOSTHENES angegebenen Wert 23 Grad 51 Min. 20 Sek., gibt aber im letzten Kapitel, wo er von der praktischen Ausführung des Astrolabs spricht, für die Schiefe 24 Grad an. Aber es bleibt bestehen, dass SEVERUS einen Philosophen vor PTOLEMAIOS für den Erfinder ausgibt. Den zweiten Grund der gegen PTOLEMAIOS als Erfinder spricht, finden wir in der Beschreibung des horologium anaphoricum bei VITRUV (6). Diese Uhr besteht aus einer Scheibe, Tympanum, die der Spinne des Astrolabs entsprechend den Tierkreis trägt. In diesem Kreis ist für jeden Tag des Jahres ein Loch gebohrt, in das ein Stift mit einem die Sonne vortstellenden Knopf eingesteckt werden kann. Vor der Scheibe steht ein Drahtgestell, das aus den Stundenlinien gebildet wird. Die Scheibe wird durch Wasserkraft in 24 Stunden einmal herumgedreht, dabei gibt der Sonnenknopf die Zeit an. Voraussetzung dabei ist, dass der Tierkreis der Scheibe und die Stundenlinien die Lage haben, wie beim Astrolab. Dann aber ist diese Uhr nichts anderes als ein mechanisches Astrolab und ihr Erfinder, dessen Namen VITRUV nicht nennt, muss das Astrolab gekannt haben. Nun sagt VITRUV in demselben Kapitel bei der Aufzählung der verschiedenen Sonnenuhren : *arachnen* EUDOXUS *astrologus (sc. invenisse dicitur), nonnulli dicunt* APOLLONIUM. NAU setzt nun in der genannten Arbeit diese arachne gleich dem Astrolab, weil ein Teil des Astrolabs arachne genannt wird und erklärt EUDOXOS oder APOLLONIOS für den Erfinder des Astrolabs. Das scheint mir ein zu kühner Schluss. Ich glaube nicht, dass VITRUV das Astrolab gekannt hat, das Horologium anaphoricum wird er einem griechischen Werke entnommen haben. Gegen EUDOXUS, 408-355, und APOLLONIOS, wenn der Pergaeer gemeint ist, um 262, aber sprechen wichtige Gründe. EUDOXOS verlegte in seiner frühen Zeit die vier tropischen Zeiten auf den 8. Tag oder Grad von Widder, Krebs, Wage und Steinbock, später in die Mitte dieser Zeichen, seine Schule gründete er in Kycikos am Marmora-Meer, was mit der Breite von 36 Grad schlecht stimmt. Die Teilung des Kreises in 360 Grad kommt bei den

(6) *De architectura*, IX, cap. 9.

Griechen zuerst als Neuerung vor bei HYPSIKLES, um 170, und HIPPARCH gilt als der erste Astronom, der sie bei seinen Instrumenten konsequent einführte. Endlich hat HIPPARCH die stereographische Projektion nach übereinstimmender Annahme als erster angewandt, und ohne sie ist das Astrolab nicht möglich. Und, wenn es nun festzustehen scheint, dass das Astrolab vor PTOLEMAIOS erfunden wurde, so möchte ich es dem grössten Astronomen des Altertums, HIPPARCH zusprechen. Für die arachne des EUDOXOS bleibe ich bei der Annahme, dass es sich um eine ebene vertikale Sonnenuhr handlet, deren Stundenlinien und Tierkreislinien mit einem Spinnennetz die grösste Aehnlichkeit haben. Bestärkt wird diese Ansicht noch durch eine weitere von VITRUV genannte Sonnenuhr, conarachne (nicht das unverständliche gonarche), der Kegelspinne, bei der die genannten Linien auf der Innenfläche eines Hohlkegels liegen (7).

Das *Astrolab* des PHILOPONOS enthält folgende Teile :

1. Den Behälter (mater astrolabii) mit der Aufhänge vorrichtung, einem geteilten Quadranten auf der Rückseite und einer Kreiseinteilung in 360 Grad auf dem vorstehenden Rande der Vorderseite.
2. Scheiben für verschiedene Klimata, sie zeigen den Horizont mit seinen Parallelen und die Stundenlinien, tragen den Namen und die geographische Breite des Klimas und die Länge des längsten Tages.
3. Die Spinne mit dem Tierkreis und einer Anzahl heller Sterne.
4. Das Diopter, das auf der Rückseite liegt.
5. Die, die Teile zusammenhaltende, Achse.

Die gleichen Teile enthält das Astrolab SÊBÔKHTS, ob es ausserdem noch Azimutlinien enthielt, scheint mir zweifelhaft. Eine Stelle lautet nach NAU : Le philosophe s'imagina de graver pour chaque climat sur les tablettes dont nous avons parlé, la hauteur qui va du sud au nord, puis d'écrire la longitude qui va de l'est à l'ouest et la même sur le bord de la tablette extérieure. Unter longitude will NAU hier Azimut verstanden haben, er sagt aber, dass SEVERUS dasselbe Wort für angle horaire und longitude gebrauche. So halte ich es für möglich, dass es sich um eine

(7) RAYET, Sur les cadrans coniques. *Ann. de chimie et de physique* III[e] Série, t. 6, 1875.

Kreiseinteilung handelt, wie sie auf manchen Scheiben vorkommt, la même sur le bord, umsomehr, als in der ganzen Arbeit nirgends vom Azimut die Rede ist.

Dagegen findet man die Azimutlinien schon in den ältesten arabischen Schriften über das Astrolab, bei MÂSHÂLLÂH. Ende des 8. Jahrh. und bei 'ALÎ IBN 'ÎSÂ, um 830. Es ist also möglich, dass diese Linien von den Arabern hinzugefügt wurden.

Erhalten ist uns kein Astrolab aus vorarabischer Zeit. Das älteste in der Nationalbibliothek zu Paris stammt aus der Zeit um 950, es war von AḤMAD BEN KHALAF für JA'FAR (906-987), den Sohn des Chalifen AL-MUKTAFÎ BILLÂH gemacht.

Zum leichteren Verständnis habe ich die Abbildung eines Astrolabs genau nach der Beschreibung des Textes hinzugefügt.

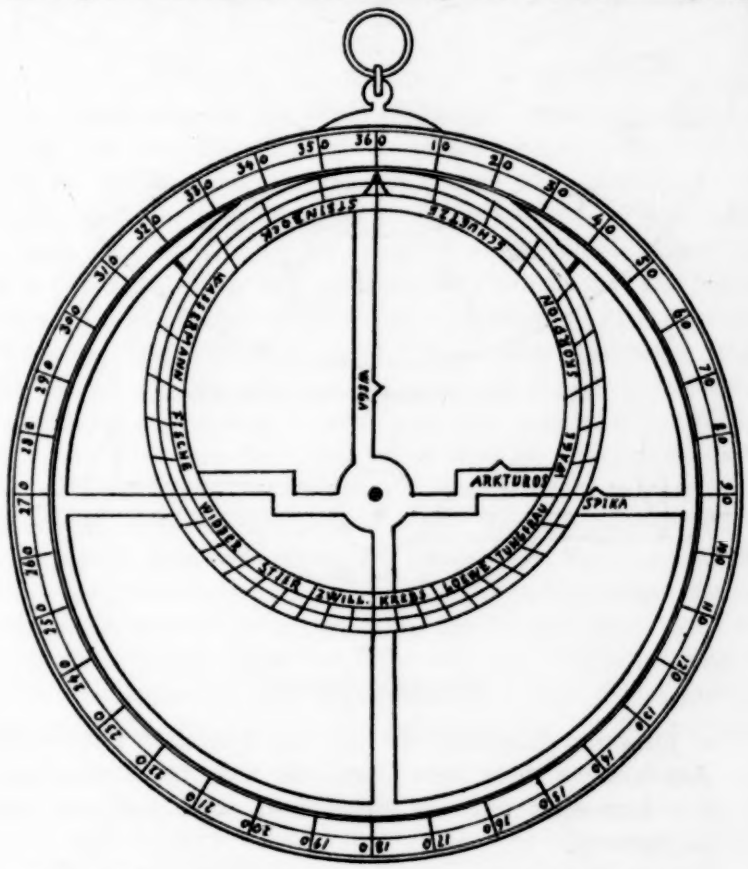

Abb. 1. Die Vorderseite des Astrolabs mit der eingelegten Spinne.

In der Spinne sind nur die drei im Text erwähnten Sterne an den Orten, die sie zur Zeit des PHILOPONOS inne hatten, angebracht.

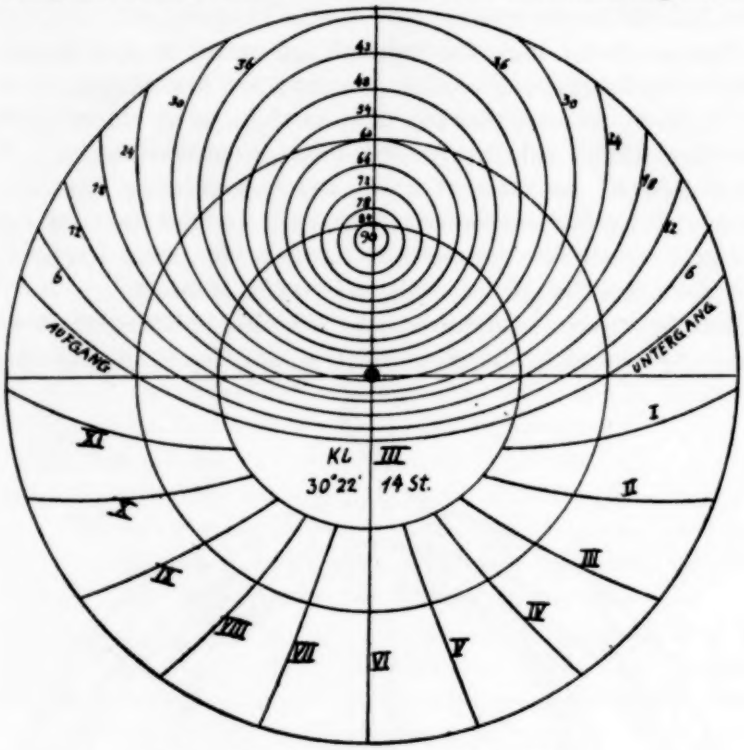

Abb. 2. Eine Scheibe für das dritte Klima.

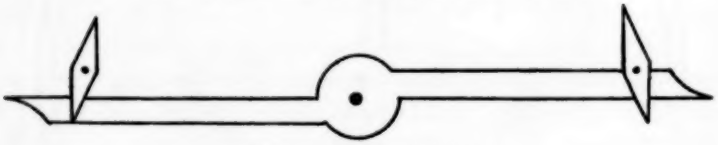

Abb. 3. Das Diopter.

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ÜBERSETZUNG.

DES JOHANNES ALEXANDRINUS MIT DEM BEINAMEN PHILOPONOS ABHANDLUNG ÜBER DEN GEBRAUCH UND DIE EINRICHTUNG DES ASTROLABS UND DIE BEDEUTUNG ALLES AUF IHM VERZEICHNETEN.

Ich werde versuchen, soweit ich dazu imstande bin, deutlich

zu erklären die Darstellung der sichtbaren Teile der Sphaere auf dem Astrolab und die Bedeutung des auf ihm Dargestellten, ferner seinen Gebrauch, und zu wie vielen und zu wie vielerlei Dingen es nützlich ist. Zwar ist es schon hinlänglich von dem Philosophen AMMONIOS, unserem Lehrer, bearbeitet, gleichwohl bedarf es noch weiterer Erklärung, damit es auch denen, die nicht damit vertraut sind, leicht begreiflich werde. Dies zu unternehmen, bin ich von Nahestehenden angeregt worden. Zuerst nun sprechen wir von jedem Einzelen, was auf dem Astrolab eingezeichnet ist.

Ueber die Einzeichnungen auf der Fläche, auf der das Diopter liegt, und für was jegliches von dem Eingezeichneten die Erklärung gibt.

Die beiden Geraden also auf der Seite, auf der das Diopter liegt, die einander in der Mitte schneiden, entsprechen dem Meridian und dem Horizont. Die von oben, von dem Ringe, durch den wir das Instrument aufhängen, herab nach unten geht, entspricht dem Meridian für jedes Klima, die andere die jene rechtwinklig schneidet, entspricht dem Horizont. Ueber dieser, die dem Horizont entspricht, steht ein Halbkreis, der als Durchmesser diese Linie selbst hat, der also der über der Erde liegenden Halbkugel des Himmels entspricht. Diesen Halbkreis hälfet die andere von den Linien, die von dem Ringe herabkommt, von der wir sagten, dass sie dem Meridian entspricht. Der Schnitt aber ist am oberen Ende der Linie, dem an dem Ringe. Jeder von den durch jede der Linien gebildete Quadrant ist in 90 Grad geteilt (8), durch die wir die Höhe über dem Horizont der Sonne oder irgend eines anderen Sternes messen, wie viel Grad er über dem oestlichen oder westlichem Horizonte zu jeder Stunde sich erhebt. Es ist aber der 90. Grad das Zeichen nach dem Zenit über jedem Ort, der erste Grad aber zeigt das, was beim Horizont selbst ist, entweder das Aufgehende oder das Untergehende, wie es der Gebrauch des Instrumentes uns im Weitergehen

(8) HASE hat hier nach dem Zwischensatz « auf denen der Gradmesser des Diopters liegt » der ihn veranlast den Plural des folgenden Relativs in den Singular zu ändern.

Der Zwischensatz ist aus einer Randnote in den Text geraten (TANNERY).

lehren wird. Es ist aber nicht auf allen Astrolabien jeder der beiden Quadranten in 90 Grad geteilt, sondern nur einer von beiden, denn es reicht einer allein aus, welcher es zufällig sein mag, zum Visieren, denn an jedem von beiden ist zu erkennen, wie viel sich über dem westlichen oder oestlichen Horizont die Sonne oder irgend ein Stern erhebt. Aber damit uns das Visieren leichter wird, wenn wir das Instrument mit jeder von beiden Händen erheben, deshalb sind in manchen Astrolabien beide Quadranten gezeichnet.

Ueber die Darstellung auf den Scheiben, auf denen die Klimata eingeschrieben sind, und wem jedes Eingeschreibene entspricht, und wieviel Grad die Schiefe der Ekliptik hat.

Die Zeichnung der Fläche, auf der das Diopter liegt, ist also auf diese Art angeornet, die aber auf den Scheiben, auf denen die Klimata angezeigt sind, verhält sich so. Auf jeder Seite der Scheibe sind wieder zwei Gerade, die einander in gleicher Art schneiden, von denen die Eine, da sie von den Ringe nach unten verläuft, wiederum dem Meridian entspricht, die Andere dem Horizont. Es sind dieselben Linien wie auf der gegenüberliegenden Seite, der das Diopter aufliegt. Deshalb sind sie jenen gleichgeordnet anzupassen. Es sind aber auch auf dem oberen, gegen das Gehänge gelegenen Teile der Scheibe Kreise gezeichnet, und zwar auf den eingradigen Astrolabien 90, auf den zweigradigen 45, wie auch auf den dreigradigen 30, oder wie es etwa den Verfertigern passte. Von diesen nun entspricht der äussere grössere dem Horizont, und wenn es möglich war den Kreis auszustrecken, so passt er sich der Graden an, die den Meridian schneidet. Da nun dies, übrigens natürlich, nicht möglich ist, so überragt so viel beiderseits von den Spitzen die Gerade, wieviel von seiner Krümmung von der Mitte der Geraden Abstand hat. Aber so wie die Gerade auf der Ebene die Grenze bildet zwischen der Halbkugel über der Erde und der unter der Erde, so tut es der Kreis auf der Kugel. Die aber im Inneren gelegenen und umschlossenen Kreise sind die Parallelen zum Horizont, sie haben einen gegenseitigen Abstand vom Horizont her nach dem oberen Teil, der dem über der Erde gelegenen entspricht, in den eingradigen Astrolabien von einem Grad, in den zwei-

und dreigradigen von zwei und drei Grad, so dass von ihnen die Halbkugel über der Erde kranzförmig geschnitten wird, welche Lage auch die Parallelkreise in der mühlenartigen Form des Alls haben (9). Daher sind immer die inneren, höher über dem Horizont gelegenen, notwendig kleiner, da sie einen kleineren Kreis von der über der Erde gelegenen Halbkugel abschneiden. Gezeichnet werden die genannten Kreise, denen die auf dem Instrumente entsprechen auf der Kugel um den Punkt im Zenit eines jeden Ortes als Mittelpunkt, als Radius dient beim Horizont die Linie, die vom Zenit aus durchgeht bis zum Ende (10) des Durchmessers des Ganzen, bei den folgenden nehmen wir immer von diesem Durchmesser einen Grad weg bei den eingradigen Astrolabien, oder zwei oder drei, wie bei den zwei oder dreigradigen. Es ist aber klar, dass, da dieser Radius 90 Grad hat, denn er hat den Bogen eines Quadranten, die Wegnahme soweit gemacht wird, bis dass der Abstand vom Zenit ein Grad ist wie bei den eingradigen, oder zwei oder mehere, wie bei den übrigen. Der Punkt aber zwischen den Kreisen, an dem der 90. Grad angeschrieben steht, entspricht dem Zenit jedes Ortes, so dass dieser Punkt denselben Wert hat wie der obere Endpunkt der Linie auf der anderen Seite, auf der das Diopter liegt, also wie der gegen das Gehänge. Jedem der beiden Punkte ist dieselbe Zahl, 90 Grad, angeschrieben. Diese Kreise halbiert der Meridian, von dem wir gesagt haben, dass ihm die Linie entspricht, die von dem Ringe her durch diese Kreise hinabläuft, so dass die linksseitigen Halbkreise, wenn dass Instrument unserem Auge gegenüber liegt, den Osten, wo auch der Aufgang angeschrieben steht, bedeuten. Hier befindet sich die Sonne und jeder Stern, wenn sie sich vom Aufgange bis zum Süden bewegen. Andersets bedeuten die rechtsseitigen den Westen, denen wiederum der Untergang angeschrieben ist, in ihnen befindet sich, was vom Süden sich bis zum Untergang bewegt. Offenbar aber sind wegen der beschränkten Ausdehnung des Instrumentes nicht alle Kreise vollständig, sondern die äusseren, grösseren über den Umfang der Scheibe hinausragenden sind nur halbvollendet.

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(9) Die Ausdrücke kranz- und mühlenförmig finden wir schon bei älteren Griechen z. B. μυλοειδῶς bei THEODORET, μυλοείδης κίνησις bei AUTOLYKOS, στέφανος bei PARMENIDES.

(10) Nach der Korrektur TANNERYS.

Es steht an diesen Kreisen ihre Zahl von 1-90, so viel Grade beträgt nämlich, wie ich sagte, der Abstand des Horizontes vom Zenit. Auch das muss klar sein, dass die Zählung von Horizonte an beginnt, indem ihre Zahlen bei den äusseren unvollständigen jedem ihrem Halbkreise, dem oestlichen und westlichen angeschrieben sind, bei den inneren und vollständigen ist die Gradzahl der Kreise angeordnet auf der Meridianlinie. Für selbstverständlich halte ich es, dass auf den zwei- und dreigradigen Astrolabien der Zwischenraum der Kreise abgegrenzt wird nach den ausgelassenen. Diese Kreise haben den gleichen Wert, wie die auf dem Quadranten der Fläche, auf der das Diopter liegt, eingetragenen Grade, über die wir im Anfang gesprochen haben. Der Halbkreis nun der Scheibe, auf dem die genannten Kreise eingezeichnet sind, entspricht der Halbkugel über der Erde, der Rest der unter der Erde, der geteilt wird in 12 Abschnitte nach der Zahl der 12 Stunden, welche in beiden Halbkugeln, sowohl der über der Erde, als auch der unter der Erde die sich bewegende Sonne verursacht. An diesen Linien ist auch die Zahl der Stunden angeschrieben, wobei die erste Stunde vom Untergang ihren Anfang nimmt, den Grund dafür werden wir im Weitergehen angeben. Es sind aber auch drei andre Kreise auf den genannten Parallelkreisen eingezeichnet, die diese schneiden, einander aber umfassen, von denen der innere dem Sommerwendekreise entspricht. Wird die Spinne herumgeführt, so wirst du sehen, dass der erste Grad des Krebses, in dem sie Sonne die Sommerwende macht, eben diesen Kreis beschreibt. Von ihm ist der Teil über der Erde der grössere, dies ist der durch die Parallelkreise geführte Teil, der kleinere, der unter der Erde, ist der, der auf dem übrigen Teile der Scheibe liegt, auf dem die Stundenlinien gezogen sind, der ja, wie wir gesagt haben, der unter der Erde gelegenen Halbkugel entspricht. Der zweite nach diesem und ihm benachbarte umschliessende Kreis entspricht dem Aequator, weshalb die beiden Tagnachtgleichenpunkte durch ihn hindurchgehen, der Anfang des Widders sowohl wie der Anfang der Wage. Von ihm sind beide Halbkreise gleich, der durch die Parallelkreise gezeichnete, der ja über der Erde ist, und der durch die Stundenlinien, der offenbar unter der Erde ist. Von diesen zwei Kreisen sind auf manchen Instrumenten nur die Halbkreise unter der Erde eingeprägt, die übrigen, die durch

die Parallelkreise zu führen waren, werden im Sinne gehalten, damit die Linien der Parallelkreise nicht von ihnen geschnitten werden. Der dritte aber, der die beiden umschliesst, ist dem Winterwendekreis gleich zu setzen, woher denn der Anfang des Steinbocks, durch den die Winterwende entsteht, diesen Kreis durchläuft. Und deswegen ist der Teil dieses Kreises über der Erde, das ist der durch die Parallelkreise gezogene der kleinere, der aber unter der Erde, der offenbar durch die Stundenlinien geht, der grössere. Von diesen drei Kreisen, ich meine den Sommerwendekreis, den Tagnachtgleichenkreis, und den Winterwendekreis trennt der erste Parallelkreis den über der Erde befindlichen Teil von dem unter der Erde, da wir doch auch sagten, dass er dem Horizont entspreche. (11) Es ist aber der Abstand vom Winterwendekreis zum Sommerwendekreis 48 Grad, wie an der Zeichnung der Parallelkreise zu erkennen ist. Der Sommerwendekreis steht nach dem Norden hin 24 Grad vom Aequator ab, die Winterwende nach Süden hin die üblichen 24 Grad. Passt du die Spinne irgendeinem der Klimata an und merkest dir den Parallelkreis, wo der gegen den Meridian hin gedrehte Anfang des Steinbocks haftet und dann zweitens, wo die Anfänge des Widders und der Wage haften, und drittens wo der Anfang des Krebses haftet und zählst die zwischen liegenden Parallelkreise, so wirst du von dem Steinbock bis zum Widder und der Wage 24 Parallelkreise finden, von dem Widder und der Wage bis zum Krebs die anderen 24, so dass es vom Steinbock bis zum Krebs 48 sind, welchen Abstand ja die Schiefe der Ekliptik inne hat. Eingetragen wird auch das Klima, für das auf jeder Fläche die Zeichnung gemacht ist, und wieviel Aquinoctial stunden der längste Tag in jenem Klima hat, und wie weit das betreffende Klima vom Aequator absteht. Um dieselben Grade erhebt sich offenbar der Nordpol über den Horizont, und steht der Südpol unter der Erde, denn es ist klar, dass der Nordpol soweit über dem Horizont erhoben ist und der Südpol unter der Erde liegt, als jeder Ort vom Aequator entfernt ist. Auf manchen Astrolabien und am meisten auf den eingradigen ist

(11) HASE hat hier noch den Satz « Von der Winterwende bis zur Sommerwende ist die Breite des Zodiakus 47 Grad 48 Minuten 40 Sekunden, der offenbar, weil im Widerspruch mit dem folgenden, aus einer Randbemerkung in den Text aufgenommen worden ist. Ptolemäus hat 47 Grad 42 Minuten 40 Sekunden. Die Zahl 48 Sekunden ist wohl als Schreibfehler anzusehen.

selbst die Fläche, auf der das Diopter liegt, für irgend eins von den Klimaten gezeichnet. Bei manchen ist der äussere Umfang in 360 Grad geteilt.

Ueber die Eintragungen auf der Spinne.

Soviel über die Scheiben, und was jedes von dem darauf Dargestellten bedeutet. Die darauf liegende Spinne aber enthält den Tierkreis und einige von den helleren Fixsternen. Der vollständige von aussen her beginnende Kreis auf ihr ist eben der Tierkreis, die übrigen unvollständigen enthalten einige Fixsterne, über die wir zur rechten Zeit sprechen werden. Auf dem Tierkreis sind eingetragen die 12 Zeichen, vom Widder bis zu den Fischen. Jedes Zeichen wird auf den eingradigen Instrumenten in 30 Grad eingeteilt, auf den zweigradigen in 15 und natürlich auf den dreigradigen in 10, wie sich auch die Zeichnung der Parallelkreise verhält. Der Anfang der Grade jedes Zeichens liegt auf der Seite, gegen die der erste Buchstabe des Zeichens eingeschrieben ist, oder anders an der Seite, gegen die das ihm vorangehende Zeichen sich befindet, sowie das dem Widder vorangehende Zeichen die Fische sind, an dem Teil nun bei den Fischen ist der Anfang des Widders, und so ist es bei allen. Von den Strichen aber, die die Grade bezeichnen, die zum Teil durch die ganze Breite des Tierkreises hindurchgehen, zum Teil nur bis zur Mitte reichen, geben die ganz hindurchgehenden den Anfang eines jeden Zeichens, denn diese bilden das Ende des vorangehenden und den Anfang des folgenden Zeichens. Dies nun ist die Zubereitung des ganzen Instrumentes. Es ist an der Zeit das Uebrige und seinen Gebrauch vollständig darzustellen.

Ueber das Erspähen der Sonne am Tage, und wie wir es kunstgemäss handhaben.

Wenn wir am Tage mit dem Instrument die Stunde der Sonne erfahren wollen, dann heben wir das Instrument an dem Ringe, so dass der Quadrant auf ihm, der in 90 Grad geteilt ist, gegen die Sonne gerichtet ist, dann drehen wir nach und nach das Diopter hinauf und hinunter längs diesen selben Quadranten hin, bis ein Strahl, der durch das gegen die Sonne gerichtete

Loch des Diopters gegangen ist, in das andere gegen uns gerichtete fällt. Damit wir aber nicht ohne Anwendung einer vernünftigen Methode das Instrument in bezug auf das Durchschauen falsch gebrauchen, ist es nötig, dass das Instrument eine solche Lage haben muss, dass sein äusserer Umfang, ich meine die Peripherie von der Sonne beschienen wird, jede der beiden Flächen aber im Schatten bleibt. Der Grund aber ist dieser, dass dem Pole des Horizontes, oder, was dasselbe ist, dem Zenit der Punkt der Aufhängung entspricht, dem Parallelkreis aber, den die gerade beobachtete Sonne trifft, der Umfang des Instrumentes. Dieser muss also so liegen, dass er in derselben Ebene mit dem Parallel, den gerade die Sonne trifft, liegt. Und es wird wohl so sein, wenn genau auf den Rand des Instrumentes die Sonnenstrahlen auffallen, gleich als ob das Gestirn auf ihm liege. Wenn nun das Instrument in diese Lage gebracht ist, muss das Diopter, wie ich sagte, sanft nach oben und unten gedreht werden auf dem einen Quadranten des geteilten Halbkreises, der gegen die Sonne gerichtet ist, bis, wenn das Diopter in gerader Linie zur Sonne liegt, der Sonnenstrahl, der durch das Loch des gegen die Sonne gerichteten Plättchens hindurch gegangen ist auch hindurchgeht durch das Loch des auf uns zu gelegenen Plättchens. Beim Drehen des Diopters wirst du das gleichgrosse und gleichgestaltete Licht um das Loch herumirren und durch die Bewegung des Diopters bald hierhein bald dorthin gelangen sehen. Man muss nun das Diopter langsam bald hierhin bald dorthin drehen, bis wir das Licht auf die innere Fläche des gegen uns liegenden Plättchens fallen sehen, und dass es sich dem Loch auf ihm anpasst, dann bleibt etwas von ihm übrig oder es wird selbst unsichtbar, gleich als ob es durch den leeren Raum ginge. Wenn du nun die Hand dem gegen uns zu gelegenen Loch näherst, wirst du das Licht auf sie fallen sehen. Allseitig unsichtbar wird das Licht, wenn die Oeffnung, durch die es zuerst gegangen, kleiner wäre als die zweite, oder ihr genau gleich; wenn sie aber grösser gefunden würde, so überragte das Licht die zweite Oeffnung auf der inneren Fläche des gegen uns zu liegenden Plättchens. Wenn dies nun zutrifft, so muss man mit Tinte oder dergleichen den Strich bezeichnen, auf den der Gradzeiger des Diopters fällt (das ist eben das in eine Schneide endigende Ende des Lineals) und messen, der wievielte es ist angefangen von unten am Horizont, ob es

nun vor Mittag war, als die Beobachtung gemacht wurde, oder nach Mittag. Wieviel Grad es nun sein mögen vom Horizont an, soviel beträgt auch die Höhe der Sonne vom Aufgang oder vom Untergang an. Nachdem wir bestimmt haben den Grad, in dem die Sonne beobachtet wurde, es sei etwa der dreissigste, müssen wir entweder das Tierkreiszeichen und seinen Grad, in dem an jenem Tage die Sonne ist, aus dem Ephemeriden entnehmen, wenn wir die Tagesstunde finden wollen, oder nach der Methode finden, die wir im folgenden anzugeben im Begriffe sind.

Ein Beispiel.

Die Sonne stehe etwa im 20. Grade des Widders. Man muss nun den 20. Grad des Widders im Zodiakus auf der Spinne mit Tinte, Wachs oder dergleichen bezeichnen, darauf zusehen, in welchem Klima wir beobachten, und die Scheibe nehmen, auf der das betreffende Klima eingeschrieben steht, und sie so dem vorliegendem Instrumente anpassen, dass das gesuchte Klima zu oberst des Ganzen liegt, und dann die Spinne darauf legen. Und wenn nun vormittags die Beobachtung stattfand, so muss man in der Scheibe des vorliegenden Klimas den dem beobachteten Grade gleichzahligen Parallelkreis nehmen, wie jetzt nach der Vorausssetzung den dreissigsten, den Anfang der Zählung machend von den Teilen, in welchen Aufgang angeschrieben ist, wenn es aber nachmittags war, machen wir auf der vorliegenden Scheibe den Anfang dort, wo Untergang geschrieben steht. Dann muss man diesen Kreis mit Tinte in meheren Punkten beinahe auf der ganzen Linie bezeichnen. Ist aber das Astrolab kein eingradiges, sondern ein zwei oder dreigradiges, und fällt die beobachtete Gradzahl in den Zwischenraum der Kreise, so muss man offenbar den Zwischenraum analog teilen, und den Ort, wohin die gesuchte Zahl fällt, in gleicher Weise mit mehreren Zeichen nach oben und unten hin zeichnen. Ist dies geschehen, so muss man die Spinne drehen, bis das Zeichen und der Grad, den die Sonne inne hat, dem Parallelkreise anliegt, in dem die Sonne beobachtet war, und den wir mit mehreren Punkten zu bezeichnen empfahlen, weil es sonst nicht zu erkennen wäre, an welchen von ihnen der Grad der Sonne haftet beim

Drehen der Spinne. Ist dies aber geschehen, so muss man wissen dass es, welche Lage das All in jener Stunde hat, feststeht, dass auch das Instrument dieselbe dem All gleichgeordnete Lage hat. Darauf muss man den Grad nehmen, der der Sonne diametral gegenüber liegt, wie jetzt den 20. der Wage und mit Tinte bezeichnen, in welchem Punkte der Scheibe er liegt. Er liegt aber durchaus in dem Teile, der dem unter der Erde Gelegenen entspricht. Dann zählt man so die Stundenlinien von der ersten an, die in dem Teile des Unterganges den Anfang nimmt, um die vollen Stunden der Sonne zu zeigen oder auch den Bruchteil, wenn der Gegenpunkt der Sonne nicht auf eine Stundenlinie fällt, sondern in den Zwischenraum. Dieses gilt auch für eine Beobachtung am Nachmittag. Dabei ist nur der Unterscheid, dass wir beim Zählen der Parallelkreise bei den Beobachtungen am Vormittag vom Aufgang her den Anfang der Zählung machen, bei denen am Nachmittage aber vom Untergange her. Die Stunden freilich zählen wie immer beim Untergange beginnend, sei es dass die Beobachtung am Tage, sei es dass sie Nachts gemacht war. Davon werden wir nun den Grund angeben.

Weshalb die Stundenlinien in dem Abschnitt eingezeichnet werden, der dem unter der Erde gelegenen entspricht, und weshalb wir den Anfang ihrer Zählung auf den Untergang verlegen, und wie man den Bruchteil der Stunde erhält.

Als PTOLEMAIOS sich des grössten Eifers für Deutlichkeit und Leichtfasslichkeit befleissigte, war er sich bewusst, dass, wenn er die Zeichnung der Stunden auf dem der oberirdischen Halbkugel entsprechenden Teile, auf dem er auch die Zeichnung der Parallelkreise gemacht hatte anbringen würde, er Verwirrung hineinbringen würde in das Instrument und Unhandlichkeit für die Gebraucher in Bezug auf die Unterscheidung, welche Linien Stundenlinien, und welche Parallelkreise bedeuten. Deswegen zeichnete er die Stunden auf den anderen Halbkreis. Da das nun klar ist, dass, wie gross der Teil des Kreises ist, den die Sonne in jedem Zeichen durchläuft so gross auch der Teil unter der Erde sein wird, den das der Sonne diametral gegenüberliegende Zeichen beschreibt [der 20. Grad des Widders beschreibt über der Erde den gleichen Teil des Kreises, den unter der Erde der 20.

Grad der Wage beschreibt, und bei allen verhält es sich bezüglich des Gegenpunktes ebenso], und dass der Gegenpunkt unter der Erde gerade so weit vom westlichen Horizont absteht, als die Sonne über der Erde vom oestlichen Horizont, so macht es keinen Unterschied im Erkennen der Grösse des Abstandes, den die Sonne vom Aufgange hat, ob man diesen selbst misst oder den des Gegenpunktes unter der Erde vom westlichen Horizont. Dass es das Gleiche ist, ist, wie wir sagten, bewiesen. Da er nun wegen der Verwirrung der Linien die Zeichnung der Stunden auf dem der über der Erde gelegenen Halbkugel entsprechendenden Teile nicht in angenehmer Art machen konnte, und sie deshalb in den gegenüberliegenden Halbkreis verlegte, so nimmt er aus diesem Grunde den Gegenpunkt der Sonne und untersucht, wieweit er unter der Erde vom westlichen Horizont sich fortbewegt hat, und ebenso gross wurde die Bewegung der Sonne über der Erde vom östlichen Horizont aus erkannt. Dies ist num der Grund, weshalb man den Gegenpunkt der Sonne nimmt, durch den auch vom Untergange her die Zählung der Stunden auf der Hemisphaere unter der Erde geschieht. Damit wir aber auch genau erkennen, wie gross der Bruchteil der Stunde ist, wenn der Gegenpunkt der Sonne nicht auf eine Stundenlinie selbst sondern in den Zwischenraum fällt, so müssen wir den Ort, in den er fällt, mit einem Zeichen versehen, dann auf dieses Zeichen eine mit Tinte angefeuchtete Feder setzen und sie unbewegt in dem auf der Spinne gefundenen Grade festhalten und sie zugleich mit der Spinne bis zu den beiderseits gelegenen Stundenlinien drehen, und die ganze durch die Tinte auf der Scheibe entstandene Linie mit einem Faden, oder dergleichen messen, dann untersuchen, der wievielte Teil der ganzen Linie es ist bis zu dem Punkte, in dem der Gegengrad des beobachteten lag. Auf diese Art wird erkannt der Bruchteil der Stunde.

Eine andere Methode.

Kunstgerechter ist das Auffinden des Bruchteils der Stunde auf andere Art. Man muss auf einen von den Gradstrichen der Spinne achten, wieviele Parallelkreise und Teile davon er durchläuft in der Zeit, dass der gefundene Grad des Zodiakus den ganzen Zwischenraum zwischen den beiden Stundenlinien, in

dem er liegt, durchläuft, dann muss man wieder oben zusehen, wieviele Parallelkreise und Teile davon dasselbe Gradzeichen durchläuft in der Zeit, dass der Grad den gesuchten Teil der Stunde durchläuft, bis zu dem Zeichen in dem Zwischenraum, in dem er lag, und so findet man das Verhältnis des Teiles zum Ganzen, zum Beispiel, wenn der Gradstrich in Bezug auf den ganzen Abstand der Stundenlinien vier und einen halben Parallelkreis durchläuft (12), dann sage, dass der dritte Teil der Stunde der gesuchte ist. Dies kann auch geschehen auf den Instrumenten bei denen der äussere Umfang der Scheiben oder ihres Behälters in 360 Grad geteilt ist, durch den auf sie haftenden Gradzeiger der Spinne. Wir zählen wieviel Grad der Zeiger in der ganzen betreffenden Stunde durchläuft, dann wieder, wieviel der Zeiger in dem vollendeten Teile der Stunde durchläuft, von dem wir suchen, der wievielte Teil er von der ganzen Stunde ist. Aus dem Verhältnis dieser Grade für die ganze Stunde und der für den Teil werden wir ersehen, der wievielte Teil einer ganzen Stunde der gesuchte Teil ist.

Dass auch die vier Spitzen (13), *nämlich der Horoskopos, die Mitte des Himmels und die diesen diametral gegenüberliegenden gleichzeitig sichtbar werden, und dass es möglich ist, sie in den Instrumenten auf der betreffenden Scheibe zu erblicken.*

Aus eben dieser Lage erhalten wir auch die vier Spitzen, den Horoskopos und die Mitte des Himmels und die diesen Punkten diametral gegenüberliegenden, ich meine den Untergang und die Himmelsmitte unter der Erde. Wenn nämlich der Grad des Zodiakus, in dem die Sonne steht, wie sie jetzt auf dem 20. Grade des Widders steht, dem Parallelkreise aufliegt, in dem sie gefunden wurde, hier dem 30. vom Aufgange an, so muss man nachsehen, welches das aufgehenden Zeichen ist, und der wie-

(12) Hier fehlt die Angabe der Zahl der Parallelkreise für den Teil der Stunde. Aber diese Bestimmungmethode ist falsch, dagegen ist die folgende richtig.

(13) Ich habe das griechische Wort κέντρα mit Spitzen übersetzt, gemeint sind die 4 Hauptpunkte des Astrolabs, die man später cardines oder anguli nannte. Bei Sṯbôkht werden sie mit den astrologischen Namen, Leben, Väter, Hochzeit, Himmelsmitte bezeichnet und es wird angedeutet, dass zwischen je zweien noch 2 andere liegen (12 himmlische Häuser). Philoponos hält sich vom Astrologischen frei.

vielte Grad und Teil des Grades an dem Horizonte haftet, und erklären, dass sei der Horoskopos, ebenso muss man zusehen, welches Zeichen untergeht, und welcher seiner Grade dem westlichen Horizonte, d.i. dem äussersten gegen den Untergang gelegenem Parallelkreise, anliegt, und sagen, dies sei die Untergangsspitze. Es ist aber klar, da das dem Aufgehendem diametral gegenüberliegende das Untergehende ist. Ferner ist zu beachten, welches Zeichen und der wievielte seiner Grade es ist, der der dem Meridian entsprechenden Linie auf dem Teile der Scheibe, der der Halbkugel über der Erde entspricht, anhaftet, und hiervon ist zu sagen, es sei die Spitze der Himmelsmitte, ferner den diametral gegenüberliegenden Grad in der Mitte des Himmels unter der Erde, der auf dem anderen Teil unter dem Horizont der Linie, die dem Meridian entspricht anhaftet. Auch das muss man wissen, dass es bei den Astrolabien, in denen der Aussenrand der Scheiben in 360 Grad geteilt ist, keinen Unterschied macht, welcher Scheibe wir das Diopter für die Beobachtung anfügen, wofern sein Zeiger auf die Grade fällt. Die übrigen Teile der Beobachtung müssen wir so machen, wie wir bereits sagten, indem wir die Spinne dem in Frage kommenden Klima auflegen.

Ueber die nächtliche Beobachtung der Fixsterne in kunstgemässer Art.

Soviel nun über die Beobachtung am Tage. Ueber die Beobachtung in der Nacht möchten wir sagen, dass auf der Spinne gewisse helle Fixsterne eingetragen sind, auf dieser 17, auf jener mehr noch, von denen einige durchaus in jeder Nacht und jeder Stunde über der Erde zu sehen sein müssen, wie z.B. der in der Leyer und der Arkturus und die übrigen, die du auf der Spinne eingetragen finden wirst, bei jedem steht das dem eingetragenem Stern eigentümliche Kennzeichen. Man muss nun, wenn man nachts die Stunde erfahren will, einen von den auf der Spinne verzeichneten, über der Erde sichtbaren Stern beobachten. Die Beobachtung geschieht so : Wir erheben das Instrument an dem Gehänge, halten es über unserem Auge und lehnen die in 90 Grad geteilte Seite des Instrumentes an den beobachteten Stern, so dass sie möglichst in derselben Ebene mit dem Stern liegt.

Dann stellen wir das Auge unter das Diopter, bewegen dies langsam hierhin und dorthin, bis des Strahl des Auges durch das Loch des unteren Plättchens auch durch das Loch des oberen Plättchens hindurchgeht, und man durch beide zugleich den Stern erblickt. Hierbei ist die grösste Sorgfalt nötig, damit wir nicht das Auge vorbeiwendend, unbemerkt den Stern ausserhalb des Plättchens sehen und nicht durch sie hindurch, deshalb muss man ein Auge schliessen und nur mit dem anderen beobachten, damit nicht der genannte Irrtum entsteht. Wenn wir nun den Stern beobachtet haben, sehen wir zu, wieweit der Grad, auf den der Zeiger des Diopters fiel, vom Horizont absteht, in gleicher Art, wie es bei der Sonne geschah, und versehen ihn mit einem Zeichen. Dann suchen wir das Klima, in dem wir uns bei der Beobachtung befanden, und bezeichnen auf ihm den dem beobachteten Grad gleichgeordneten und gleichzahligen Parallelkreis wieder mit Tinte. Wenn nun der beobachtete Stern etwa in dem Quadranten vor dem Meridian war, so muss man den Parallelkreis vom Aufgange an bezeichnen, wenn aber nach den Meridian, vom Untergange an, ähnlich wie es bei der Sonne geschah. Dann legen wir die Spinne auf das Klima, in dem wir beobachteten, und suchen auf ihr den beobachteten Stern, gesetzt es sei Wega oder Spika oder ein anderer, und drehen die Spinne so, dass das Zeichen dieses Sternes dem Parallelkreise anhaftet, in dem wir den Stern beobachteten, und den wir bezeichnet hatten. Dann nehmen wir den Grad, in dem damals die Sonne war aus den Ephemeriden, oder nach einer Methode, die wir bald lernen werden, daraus werden wir finden, dass er in dem Halbkreis der Scheibe liegt, in dem die Stundenlinien eingezeichnet sind. Wir werden ihn nun mit Tinte bezeichnen und die Stunden vom Untergang an zählen, und das übrige tun wir wiebei der Sonne. So werden wir die vollendeten Nachtstunden und auch, wenn es sich trifft, den Bruchteil finden. Auf dieselbe Art werden wir die vier Spitzen auf ihrem ihnen zukommenden Ort liegend sehen.

Wie man erkennen soll, ob die Sonne oder jeder einzelne Fixstern vor, in oder nach dem Meridian gesehen wird, und wie man die grösste Höhe für jeden Grad des Zodiakus findet.

Wenn nun der beobachtete Stern oder die Sonne sehr weit

vor oder nach dem Meridian stand, ist aus der Beobachtung leicht zu unterscheiden, welche Abschnitte der Parallelkreise wir gebrauchen werden, ob die vor- oder die nachmittägigen. Wenn er aber nicht weit nach dem oestlichen oder westlichen Horizont hinneigt, dann wird es zweifelhaft, ob der angeschaute Stern oder die Sonne vor oder nach dem Meridian steht. Wenn er dem Meridian sehr nahe wäre, wird es nicht zu erkennen sein, ob er vor oder nach dem Meridian steht. Wir unterscheiden deshalb auch noch diese Lage. Wenn wir die Sonne beobachten, müssen wir untersuchen, bis zu welcher höchsten Höhe, sie sich an jenem Tage erhebt, an dem wir beobachteten. Um dies zu erkennen, müssen wir das Zeichen und den Grad, in dem an jenem Tage die Sonne ist, wie in unserem Beispiel den 20. Grad des Widders, nehmen und diesen Grad auf der Spinne mit Tinte bezeichnen, diese dann drehen, bis der Grad die Linie des Mittags berührt, dann sehen dem wievielten Parallelkreis er sich anpasst. Und das sagen wir, sei die grösste Höhe der Sonne über der Erde, wenn sie im 20. Grade des Widders steht. Wenn nun darauf die beobachtete Sonne auf diesem Grade, ich meine dem der grössten Höhe gefunden wird, so steht sie offenbar gerade im Meridian, wenn sie aber in kleinerer Höhe gesehen wird, so wird sie vor oder nach dem Meridian sich befinden. Um dies zu erkennen warten wir ein wenig und beobachten noch einmal, und wenn wir dann finden, dass die Zahl der Grade grösser geworden ist, dann ist klar, dass das, was wir zuerst beobachteten, vor dem Meridian war. Und auf andere Art : wenn wir bei Beobachtung der Sonne finden, dass sie z.B. 70 Grad über den Horizont sich erhebt, und wenn wir dann nicht in der Lage wären, aus der Beobachtung zu unterscheiden, ob es vor oder nachmittags ist, dann müssen wir gleichfalls kurze Zeit warten und von neuem beobachten, und wenn die Höhe vorgeschritten und etwa 71 Grad geworden ist, dann ist es ganz klar, dass die Sonne bei der ersten Beobachtung vor dem Meridian stand, wenn sie aber abgenommen hat und etwa 69 Grad geworden ist, dann ist es wiederum klar, dass die Beobachtung nach dem Meridian gemacht wurde. Damit wir nun dies erkennen, müssen wir vom Untergange an die Parallelkreise zählen, um die sie zuerst über den Horizont erhoben beobachtet war, wie sie jetzt auf dem 70. liegt, dann von der Spinne den Grad des Zeichens in dem damals die Sonne war,

dem beobachteten Parallelkreise anpassen, wie jetzt dem 70. vom Untergange an. Wenn sie nun im Meridian sebst beobachtet worden wäre, so ist es klar, dass der Grad der Sonne auf die Linie fallen wird, die dem Meridian entspricht und die Parallelkreise schneidet, wenn aber nach dem Meridian, so wird er nach dem Untergange hin verschoben. Soviel nun über die Sonne. Bei den Sternen handeln wir wieder auf dieselbe Art, wir fragen nach der grössten Höhe, die ein Stern in dem Klima, in dem er beobachtet wurde, erreicht. Dies aber erfahren wir so, wir passen sein Kennzeichen der Graden an, die dem Meridian entspricht und sehen zu, dem wievielten Parallelkreis es sich anpasst, wenn wir es auf die Linie des Meridians gebracht haben. Das ist dann seine grösste Höhe in seinem Klima, und das übrige tuen wir so, wie wir auseinander gesetzt haben, dass es bei der Sonne geschieht. Auch die zweite Methode lässt sich jetzt anwenden. Man muss wieder kurze Zeit vorbeigehen lassen, dann beobachten und das übrige auf die gleiche Weise tuen. Wenn wir nun wider nach kurzer Zeit den Stern beobachten und die Zahl der Grade kleiner finden, fügen wir das Zeichen des beobachteten Sternes der Zahl der Parallelkreise an, in welcher wir ihn bei der ersten Beobachtung angetroffen haben (die Zählung der Parallelkreise beim Untergange beginnend), wenn wir finden, dass das Zeichen des Sternes auf die dem Meridian entsprechende Linie fällt, so sagen wir dass er im Meridian selbst gesehen wurde, wenn er aber gegen den Untergang abweigt, so liegt er nach dem Meridian. Nach dem Gesagten ist klar, was zu tun ist um die grösste Höhe eines Grades eines Tierkreiszeichens für jedes Klima zu erhalten. Man muss nämlich die Spinne auf die Scheibe des betreffenden Klimas legen, dann jenen Grad, dessen Höhe wir erfahren wollen, herum drehen, bis er die Linie des Mittags berührt, und ebenda werden wir die eingeschriebene Gradhöhe finden. So nun sind wir imstande, die Höhe eines jeden Grades zu finden. Dies ist das Erkennen der Mittagslage für jedes Klima.

Wie man findet, in wieviel Aequinoctialzeiten jedes Tierkreiszeichen aufgeht, und in wievielen es untergeht.

Noch eine andere Anwendung des Instrumentes fügen wir hinzu. Wir werden nämlich daraus erfahren, in wieviel Aequinoctial-

zeiten für jedes Klima ein jedes Tierkreiszeichen aus dem oestlichen Horizonte über die Erde erhoben wird, und in wievielen wiederum es untergeht. Zuerst muss man wissen, dass dem Teile des Instrumentes, in den die Scheiben eingelegt werden, auf den die Spinne gelegt wird, den man auch den Behälter der Scheiben zu nennen pflegt, ein Ring aufliegt, der, wie ich schon früher sagte, in 360 Teile geteilt ist, die den Teilen des Aequators entsprechen, und die man auch aequinoctiale Zeiten (14) nennt. Ist das ganze Instrument zusammengefügt, so wird der darauf befindliche Ring mit der Ebene der zu oberst liegenden Scheibe zusammen fallen, so dass das Ganze eine einzige Ebene bildet. In den eingradigen Instrumenten, bei denen meistens kein Behältnis vorhanden ist, sondern jede Scheibe selbst für sich wegen ihrer Grösse geteilt ist und nicht einer anderen aufliegt, ist überhaupt der besprochene Ring nicht vorhanden. An der Grenze jeder Scheibe, d. h. an ihrem Umfange, sind die genannten 360 Zeitteile eingraviert, auf sie fällt auch der Zeiger der Spinne.

Ein Beispiel.

Gesetzt nun wir suchen in wievielen aequinoctialen Zeiten beispielsweise der Skorpion im 3. Klima aufgeht, so müssen wir auf dieses Klima die Spinne legen, dann den ersten Grad des Skorpions dem vom Aufgange an ersten Parallelkreise anlegen, dann suchen wir, welchem Grade des genannten, in 360 Teile, die auch aequinoctiale Zeiten genannt werden, geteilten Kreises sich die am Rande der Spinne befindliche Marke, sie liegt in der Mitte ihres Aussenkreises, anfügt, und diesen merken wir an; dann drehen wir die Spinne bis der letzte Grad des Skorpions, d.i. der 30. in die Höhe kommt und sich dem ersten oestlichen Parallelkreise anlegt, dann suchen wir wieder, welchem Grade des Kreises sich die genannte Marke anfügt und merken auch diese an, dann zählen wir alle Grade von dem zuerst angemerkten bis zu dem letzten, und wieviele von den 360 Grad wir finden, die die Marke während des ganzen Aufganges des Skorpions durchlaufen hat, in sovielen aequinoctialen Zeiten behaupten

(14) χρόνος bedeudet hier Zeitgrad, d. i. 4 Minuten einer aequinoctialen Stunde. Die Bedeutung der Wörter χρόνος und μοῖρα gibt PTOLEMAIOS in Ὑποθέσεων τῶν πλανωμένων I. 3.

wir, dass der Skorpion aufgeht. Das gleiche gilt für jedes der übrigen Zeichen. So nun werden wir finden, in wieviel aequinoctialen Zeiten ein jedes Zeichen in jedem Klima aufgeht. Auf dieselbe Art werden wir auch finden, in wieviel aequinoctialen Zeiten ein jedes untergeht, indem wir den ersten Grad des fraglichen Zeichens dem letzten westlichen Parallel anfügen und den Grad, in welchen die Marke am Rande der Spinne fällt, anmerken, dann wieder drehen und den 30. Grad des Zeichens auf den westlichen Horizont setzen, d. h. auf den letzten Parallelkreis, dann wieder zusehen, wohin die Marke der Spinne fällt, und zählen wieviele aequinoctiale Zeiten sie während des ganzen Unterganges des Zeichens durchlaufen hat. In sovielen Zeiten werden wir sagen, sei das Zeichen unter die Erde hinabgekommen.

Wie wir finden, wieviel aequinoctiale Zeit auf die temporäre Stunde eines jeden Tages und einer jeden Nacht geht.

Durch dieselbe Methode kann man auch finden, aus wievielen aequinoctialen Zeiten jeder temporärer Tag (15) und jede Stunde besteht. Um dies zu finden müssen wir den Grad nehmen, in dem die Sonne ist, und ihn dem ersten oestlichen Parallel anlegen, dann den Grad anmerken, auf den die Marke der Spinne fällt, dann die Spinne herumdrehen, bis der Grad der Sonne in den letzten, gegen den Untergang gelegenen Parallel kommt, d. h. bis die Sonne die ganze Halbkugel über der Erde durchlaufen hat, darauf muss man wieder den Grad anmerken, auf den die Marke der Spinne fiel, dann die Grade zählen, beginnend bei dem zuerst angemerkten bis zu dem letzten und behaupten, soviel aequinoctiale Zeiten habe der vorliegende Tag. Diese teilen wir durch 12 und sagen, wieviele aequinoctiale Zeiten oder Teile davon die temporäre Stunde hat. Auf gleiche Art werden wir eine gegebene temporäre Nacht und die Grösse ihrer temporären Stunden finden, indem wir den Grad der Sonne auf den westlichen Horizont, der in dem äusersten Parallel liegt, setzen und anmerken, mit welchem Grade des äusseren Umfanges des Instrumentes die Marke der Spinne zusammenfällt, dann

(15) ἡμέρα καιρική, dies temporalis, die Zeit von Sonnenaufgang bis Sonnenuntergang.

drehen wir die Spinne, bis der Grad der Sonne nach Durchlaufen des Teiles der Scheibe, der dem unter der Erde Befindlichen entspricht, den oestlichen Horizont berührt, d.i. den letzten Parallel nach dem Aufgange hin. Hierauf bezeichnen wir wieder den Grad, dem die Marke der Spinne anhaftet, dann zählen wir alle Grade von dem zu Anfang angemerkten an, und behaupten, soviele aequinoctiale Zeiten habe die vorliegende temporäre Nacht. Und teilen wir diese durch 12, so finden wir auch wieviele aequinoctiale Zeiten die Nachtstunde hat. Hieraus hast du nun auch den Unterschied der temporären Stunden gegen die aequinoctialen.

Wie durch das Instrument der Stand der Sonne zu finden ist, und wie mit ihm die für jeden Tag höchste Höhe der Sonne zu bestimmen ist.

Auch der Stand der Sonne kann ohne Tabelle durch den Gebrauch des Instrumentes auf folgende Art gefunden werden. Man nehme die grösste Höhe der Sonne über der Erde an dem betreffenden Tage, wir nehmen sie aber durch Beobachtung der Sonne am Mittag. Offenbar aber muss man öfters beobachten, bis sie nicht mehr in die Höhe steigt, sondern die grösste Höhe erreicht hat und beginnt niedriger zu werden und der Erde näher zu kommen, denn es ist einleuchtend, dass der Punkt, von dem an sie wieder niedriger wird, ihre grösste Höhe ist. Nehmen wir nun diese, dann sehen wir zu, welchen Quadranten die Sonne durchläuft, ob den vom Frühlings- oder den vom Herbstaequinoctium, oder den von der Sommer- oder den von der Winterwende an, dies aber ist überall bekannt, denn auch der Anfang der Zeiten sowohl der Aequinoctien wie auch der Wenden ist allen bekannt. Wir nehmen diesen Quadranten des Zodiakus auf der Spinne und legen sie auf das Klima, in dem wir beobachten und passen jeden Grad des Quadranten, in dem zur Zeit die Sonne ist, dem Meridian an, und suchen, wer von ihnen soviele Parallele gehoben wird, wenn er in den Merdian kommt, wieviele an jenem Tage die Sonne gehoben gefunden wurde, und den erklären wir, habe die Sonne zur Zeit inne. Dies geschieht, wenn die Sonne nicht nahe bei den Wenden steht, sondern weit von ihnen entfernt ist. Wenn sie aber nahe dabei ist, bedarf es einer anderen Unterscheidung, die wir lehren werden.

Welche Grade des Tierkreises unter denselben Parallelen sind und zur gleichen Höhe sich erheben, und wie man findet, in welchem Quadranten des Tierkreises die Sonne steht, wenn sie sich nahe bei den Wenden befindet.

Keiner von den Graden in demselben Quadranten erreicht mit einem anderen die gleiche Höhe. In dem ganzen Tierkreise wirst du um die Zeichen der Wenden herum nur bei zweien dieselbe Höhe finden, es sind die, welche auf demselben Parallel liegen. Auf demselben Parallel aber sind die, die um die gleiche Entfernung abstehen von den Zeichen der Wenden, von jeder von beiden für sich, ich meine der Sommerwende und der Winterwende, die im eigentlichen Sinne Wenden sind, denn von ihnen wendet sich die Sonne nach den nördlichen oder nach den südlichen Zeichen. Von dem Steinbock nämlich beginnt sie nach Norden zu steigen bis zum Krebs, von diesem wieder beginnt sie zurückzugehen und nach Süden hinabzusteigen bis zum Steinbock. Freilich nennen auch manche die Zeichen der Tagundnachtgleichen tropische, und die meisten sagen, es gebe vier Wenden wegen des Wechsels der Stunden. Doch nur zwei Punkte sind im eigentlichen Sinne tropische, nämlich der erste Grad des Krebses und der erste Grad des Steinbocks. Ueber diese braucht man nicht genau zu reden, da sie keinen anderen gleichgestellt sind, denn kein Grad des Tierkreises erreicht mit ihnen die gleiche Höhe, sie sind ja die Endpunkte der Schiefe selbst, daher sind sie auch nicht auf demselben Parallel, weder mit einander noch mit irgendeinem Grade des Tierkreises, die aber nach beiden Seiten gleichen Abstand von ihnen haben, sind auf einem und denselben Parallel und erreichen deswegen dieselbe Höhe über der Erde. So stehen nach beiden Seiten vom Anfang des Krebses gleich weit ab der Anfang des Löwen und der Anfang der Zwillinge, denn es sind 30 Grad nach jeder Seite. Diese 2 Grade nun, der Anfang des Löwen wie auch der Anfang der Zwillinge sind auf demselben Parallel und erreichen deswegen dieselbe grösste Höhe über der Erde. Damit das Gesagte klar wird bringe man auf die beiden Grenzen der Halbkugel über der Erde die beiden Tagnachtgleichenzeichen, also etwa auf die oestliche den Anfang der Wage (16), auf die westliche den

(16) Das Sternbild der Wage heifst hier ζυγός, bei PTOLEMAIOS kommt nur die ältere Bezeichnung χηλαί vor.

Anfang des Widders. Diese, nun wirst du sehen, haben einen und denselben Parallel inne, den ersten durch den der Teil der Scheibe, der der Halbkugel über der Erde enntspricht, getrennt wird von dem unter der Erde. In dieser Lage wirst du auch den ersten Grad des Krebses und den ersten Grad des Steinbocks auf die Mittagslinie fallen sehen. Da die Aequinoctialpunkte gleichen Abstand haben vom Sonnenwendepunkte, ich meine vom ersten Grade des Krebses, so sind sie auch sozusagen auf demselben Parallel und erreichen dieselbe Höhe über der Erde. In gleicher Art wirst du die übrigen Grade, die von beiden Seiten des Krebses gleichen Abstand haben, demselben Parallel anhaften und dieselbe grösste Höhe erreichen sehen. Gerade dies wirst du auch bei denen sehen, die von den zwei Punkten der Gleichen denselben Abstand haben, denn Punkte die von einer der Wenden gleich weit abstehen, haben auch gleichen Abstand von den beiden Gleichen, jeder von einer anderen, nämlich von der einen im Vorangehen, von der anderen im Nachfolgen. Z. B. um wieviel absteht der Anfang der Zwillinge vom Anfange des Krebses, um soviel steht auch der Anfang des Löwen vom Anfange des Krebses ab, da ja der Anfang des Löwen im Vorangehen gleich weit vom Anfange der Wage absteht, wie der Anfang der Zwillinge im Nachfolgen vom Anfange des Widders. Aber nicht, weil sie von den Gleichen denselben Abstand hatten, sind sie auf demselben Parallel, sondern weil sie von den Wenden gleichen Abstand hatten. So haben gleichen Abstand vom Anfange des Widders der Anfang der Fische und der Anfang des Stieres, aber sie sind weder auf demselben Parallel, noch erreichen sie die gleiche grösste Höhe, die Fische nämlich sind südlicher, der Stier aber ist nördlicher. Aber wahrlich, wie weit im Nachfolgen vom Anfange des Widders der Anfang der Fische absteht, ebenso weit steht im Nachfolgen der Anfang der Jungfrau vom Anfange der Wage, aber sie sind nicht auf gleichem Parallel, da ja die Jungfrau nördlich ist, und die Fische südlich. Da nun die von einem der Wendepunkte gleichweit abstehenden Punkte auf demselben Parallel liegen, die beiden Gleichen aber von den Wenden gleichen Abstand haben, und auf demselben Parallel sind, so sind die Punkte, die von jedem der Gleichen denselben Abstand haben, der eine von diesem, der eine von dem anderem, der eine in der Folge der Zeichen, der andere gegen die Zeichen-

folge auf demselben Parallel. Es macht keinen Unterschied, wenn du auch den Anfang des Widders auf den oestlichen und den Anfang den Wage auf den westlichen Horizont stellen möchtest, wobei dann offenbar der Anfang des Steinbocks auf die Mitte des Himmels fiele, denn du würdest dasselbe wieder eintreffen sehen. Nun gibst es nur zwei Punkte zu beiden Seiten der Wenden, die gleiche Höhe erreichen. Wenn wir nun den Ort der Sonne suchen, während sie in der Nähe der Wendepunkte sich befindet, so wird es schwer zu unterscheiden sein, in welchem Quadranten sie gerade ist, wegen der gleichen Höhe, die Punkte in gleichem Abstande von den Wendepunkten erreichen. Es betrage z. B. die Höhe vom Anfange des Krebses 90 Grad, die der beiderseits 10 Grad von im abstehenden, d. h. des 10. Grades des Krebses und des 20. Grades der Zwillinge 87, wenn nun die Sonne am 20. Grade der Zwillinge oder am 10. Grade des Krebses steht, und wir den Ort der Sonne suchen, dann nehmen wir ihre grösste Höhe, die nach der Voraussetzung 87 Grad ausmacht und suchen, welcher Grad in den Quadranten der Spinne diese grösste Höhe erreicht und wir finden dass sowohl der 10. Grad des Krebses, als auch der 20. der Zwillinge diese grösste Höhe erreicht. Nun sind wir nicht im stande aus der Wahrnehmung zu unterscheiden, ob die Sonne vor der Sommerwende im 20. Grade der Zwillinge, oder nach der Sommerwende im 10. Grade des Krebses steht, denn dasselbe trifft auch hier zu, wie es ja zutraf, als wir die Sonne um den Meridian beobachteten. Dies nun kommt vor, wenn wir lange Zeit in der Einsamkeit zugebracht haben und vom Monat garnichts wissen, ober bei einem Volke, dass die Monate nicht nach unserer Art, oder ganz und gar nicht zählt. Wir lassen dann einen oder zwei Tage vorbeigehen und beobachten in gleicher Art, wenn wir dann finden, dass die Sonne an Höhe zugenommen hat, so ist es offenbar, dass sie bei der ersten Beobachtung vor der Sommerwende war, wenn sie aber abgenommen hat, so war sie nach der Sommerwende. Und so ist es nun auch, wenn die Sonne nahe wäre der Sommerwende oder der Winterwende. Wenn freilich die Sonne weit abstände von der Sommerwende oder der Winterwende nach der einen oder anderen Seite, bleibt demnach nur der eine Zweifel, in welchem Quadranten wir den Grad suchen müssen, der dieselbe grösste Höhe hat, unter der von uns die Sonne beobachtet

war. Wenn nämlich die Untersuchung vor der Sommerwende gemacht wäre, dann muss man suchen, welcher von den Graden vom Widder an bis zum 30. der Zwillinge d.i. bis zum ersten des Krebses dieselbe grösste Höhe über den Horizont erreicht, unter der damals die Sonne gesehen wurde, wenn aber nach der Sommerwende beobachtet wurde, dann ist zu suchen vom Anfange des Krebses bis zum 30. Grad der Jungfrau, d. i. bis zum Anfang der Wage. In gleicher Art ist zu verfahren, wenn es vor der Winterwende war, vom Anfang der Wage bis zum 30. Grad des Schützen, d. i. dem Anfang des Steinbocks, wenn es aber nach der Winterwende war, vom Anfange des Steinbocks bis zum 30. der Fische, d. i. dem Anfange des Widders.

Wie man den Ort jedes einzelnen Planeten findet.

Es ist nun auch der Ort der übrigen Planeten durch das Instrument zu erkunden, ganz genau, wenn sie in der Mittellinie des Tierkreises stehen, weniger genau, wenn sie davon abweichen, auf diese Art. Zuerst muss man einen von den der Spinne eingeordneten Fixsternen nach der schon angegebenen Methode beobachten und wenn wir dann erfahren haben, um wieviele Parallelen er über dem oestlichen oder westlichen Horizont erhoben ist, die Spinne auf das Klima, in dem wir beobachten legen, entsprechend der Lage des Alls, d. i. die Marke des beobachteten Fixsternes dem Parallel, auf dem er gesehen wurde anpassen. Dann müssen wir wiederum den fraglichen Planeten beobachten und anmerken, wieviel Parallelen er über dem weslichen oder oestlichen Horizont erhoben ist und im vorliegenden Klima den gleichzahligen Parallel suchen und von ihm den Teil, der entweder nach dem Untergange oder nach dem Aufgange hin liegt, in dem der Planet angetroffen war. Dann suchen wir mit welchem Grad des Tierkreises dieser Teil des Parallels zusammenfällt und behaupten, diesen Ort habe der damals beobachtete Planet inne. Da die Sonne sich immer in der Ekliptik bewegt trifft es natürlich zu, dass wir den Ort des Planeten durch die Beobachtung ganz genau finden, so oft er auf der Linie sich bewegt, auf der wir auch die Oerter der Sterne (17) feststellen.

(17) Das bei HASE im Text stehende *χρόνων* wurde von TANNERY in *ἀστέρων* verbessert.

In den übrigen Fällen, da die Planeten sich nicht immer auf dieser Linie bewegen, sondern oft gegen sie eine schiefe Bewegung machen, so dass sie bald nördlicher bald südlicher werden, geschieht es, wenn wir sie von dieser Linie abweichend beobachten, wenn wir die vom Auge aus auf sie gerichtete Grade gegen den Tierkreis herausrücken, dass sie nicht auf die Ekliptik selbst fallen, sondern ausserhalb entweder mehr nach Norden oder mehr nach Süden, und dass wir deshalb ihren Ort nicht ganz genau ermitteln, da ja, wie ich sagte, nur nach der Ekliptik die Festsetzung der Oerter getroffen wird.

Wie man findet, wie weit jeder Grad des Tierkreises und ebenso die Sonne, der Mond und jeder der Planeten nach Norden oder nach Süden vom Aequator absteht.

Wir werden durch den Gebrauch des Instrumentes auch ermitteln, wie weit jeder Grad des Tierkreises der Breite nach vom Aequator nach Norden oder Süden absteht, auf folgende Art. Es ist uns im Vorhergehenden gesagt worden, dass der Abstand zwischen der Winterwende und der Sommerwende die ganze Schiefe des Tierkreises bestimmt, die 48 Grad beträgt. Von dem Sommerwendekreise nämlich bis zum Aequator sind es 24 Grad, von dem Aequator bis zum Winterwendekreise die übrigen 24 Grad. Es ist nun klar, dass die Sonne, während sie den ganzen Halbkreis von der Winterwende bis zur Sommerwende durchläuft, nach Norden hin aufsteigt, umgekehrt aber von der Sommerwende bis zur Winterwende nach Süden hin niedriger wird. Offenbar aber liegt der Aequator zwischen dem Winterwendekreise und dem Sommerwendekreise, weshalb zweimal im Jahre sich die Sonne in ihm befindet, wenn sie von der Sommerwende nach der Winterwende gekommen ist, in der Wage, wenn sie aber von der Winterwende zur Sommerwende gekommen ist, im Widder, so dass die Sonne in bezug auf jeden Halbkreis bald nördlich bald südlich vom Aequator steht. Wenn wir nun wissen möchten, wie weit jeder Grad des Tierkreises auf beiden Halbkreisen vom Aequator nach Norden oder nach Süden absteht, so werden wir es auf folgende Art finden.

Von den Tagnachtgleichenzeichen muss man den Anfang des Widders oder der Wage der Mittagslinie über der Erde an-

passen und merken, auf welchen Parallel er fällt, dann wieder den fraglichen Grad des Tierkreises derselben Mittagslinie anpassen, und merken auf welchen Parallel er fällt. Ist das geschehen, dann behaupten wir jener Grad steht soweit vom Aequator ab, als wir Parallelkreise von dem des Aequators bis zu dem jenes Grades finden, ob aber das Gesuchte nach Norden oder nach Süden abweicht, erfahren wir aus dem Anblick selbst, denn wenn der fragliche Grad ausserhalb des Aequators fällt, wie nach der Winterwende hin, wie sie auf der Scheibe eingraviert ist, dann ist es offenbar, dass er nach Süden vom Aequator absteht, liegt er aber innerhalb des Aequators, wie nach der Sommerwende hin, von der wir sagen, dass sie vom Aequator umfasst wird, dann weicht offenbar der fragliche Grad des Tierkreises nach Norden ab. Das ergibt sich aber auch allein aus der Lage der Tierkreiszeichen. Wenn wir nämlich die vom Anfange des Widders bis zum 29. Grade der Jungfrau (18) untersuchen, so ist es klar, dass sie nach Norden hin vom Aequator abweichen, wenn aber die vom Anfange der Wage bis zum 29. Grade der Fische, zo werden sie die Abweichung vom Aequator nach Süden haben. Jedem ist es klar, wie wir von hier aus jederzeit ermitteln, wie weit die Sonne der Mond und jeder Planet entweder nach Süden oder nach Norden vom Aequator abweichen, indem wir sie gemäss jedem eingenommenen Grad des Tierkreises behandeln. Denn, wenn wir den Grad, den die Sonne der Mond oder Planet inne hat, nehmen und alles vorhin gesagte ausführen, werden wir das Gesuchte finden. So weit nämlich der Grad des Tierkreises nach Norden oder Süden abweicht, eine so grosse Abweichung wird auch der Stern auf ihm haben. Durch Anwendung derselben Methode werden wir auch erfahren, wie weit südlicher oder nördlicher als der Aequator jeder auf der Spinne verzeichnete Fixstern ist, und wieviel Gerade er nach der einen oder anderen Seite von ihm absteht. *Ende.*

Dorsten, Westfalen. J. DRECKER.

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(18) Im Text steht unrichtig Steinboek.

A Thirteenth Century Algorism in French Verse

INTRODUCTION.

Among the treatises introducing into Europe the Hindu art of reckoning, those in the language of the people, as opposed to those in Latin, have a particular interest as beginnings in popular education. Not many are known. In a study (1) of early algorisms made by Dr. SUSAN BENEDICT, out of some thirty algorisms which appeared in Europe before the invention of printing there are three in Hebrew, one in German, one in Icelandic, one in French, and two in English, of which one is only a brief extract on numeration.

Recently the English algorism mentioned by Dr. BENEDICT and another algorism have been published by ROBERT STEELE (2) and prove to be respectively a commentary on the *Carmen de Algorismo* of ALEXANDER DE VILLA DEI and a translation of SACROBOSCO's *Algorismus Vulgaris*, the two most widely used algorisms of the thirteenth century.

The one French algorism hitherto available was first published by CH. HENRY (3) and later by VICTOR MORTET (4). It is an incomplete treatise too brief to be useful in teaching the new arithmetic.

The present treatise, one of the earliest in any vernacular, to which my attention was called by Dr. HERBERT CRASTER of

(1) *A Comparative Study of the Early Treatises Introducing into Europe the Hindu Art of Reckoning*. Thesis, University of Michigan, 1914. Printed at the Rumford Press, Concord, N. H.

(2) *The Earliest Arithmetics in English*, edited with Introduction by ROBERT STEELE, London, 1922, Early English Text Society, Extra Series, 118.

(3) Boncompagni's *Bullettino di bibl. e di storia delle Scienze matem. e fisiche*, 15, 53.

(4) *Le plus ancien traité français d'algorisme*, *Bibl. Math.*, 3d series, 9, pp. 55-64.

the Bodleian Library, is of real importance from both the philological and the scientific point of view. It does not follow any of the known treatises. In many respects there is closest similarity to the *Carmen de Algorismo* of VILLA DEI. However, in many parts SACROBOSCO's treatise is followed, while several points correspond to the text of the thirteenth century Codex in the Salem Cloister which was transcribed by MORITZ CANTOR (5).

The section in this algorism on multiplication contains in lines 382 to 424 two rules for the learning of the multiplication table between 5 times 5 and 10 times 10 which are not found together in any of the early treatises. According to the first rule, to multiply a digit by itself, subtract from the digit the difference between the given digit and ten, this remainder is multiplied by 10 and to the result is added the square of the difference mentioned.

$$d^2 = 10\ [d - (10-d)] + (10-d)^2$$

According to the second rule, to multiply one digit by another, subtract the difference between ten and the lesser digit from the greater digit; multiply by 10; to this add the product of the two differences.

$$a.b = 10\ [a-(10-b)] + (10-a)\ (10-b).$$

This first rule is in fact a special case of the second. This general rule appears in the Salem Codex with the same square of eight as an illustration. The rule appears again in the twelfth century Algorism by Frater SIGSBOTO of the Cloister Prüfning at Regensburg, published by CURTZE (6), and also in the Egerton Manuscript 2261 in which there is a twelfth century (or early thirteenth) Latin algorism (7). N. O'CREAT (8) gives the rule for the square, but not the general rule, as an illustration of the rules ascribed to NICOMACHUS, $a^2 = (a-b)\ (a+b) + b^2$.

The only numerical illustrations given in the French algorism consist of the applications of these rules to 8 times 8, and to 8 times 7.

Another peculiarity, not so clearly found in other algorisms, is the explanation of the forms of the digits (vv. 101-110).

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(5) *Zeitschrift für Math. und Physik*, 10, 1-16.
(6) *Abhandlungen zur Geschichte der Math.*, 8, 1-27.
(7) See KARPINSKI, Two Twelfth Century Algorisms, *Isis*, 3, 396-413.
(8) In *Abhandl. zur Geschichte der Math.*, 2, 131-139, article by CH. HENRY.

Ten lines from this French algorism are quoted by J. O. HALLIWELL in connection with the *Carmen de Algorismo* (9).

As a whole the character of the treatise indicates that it was based upon one or several of the Latin treatises extant in the thirteenth century though it is possible that the authors had before them some early treatise which has not survived. The operations are of the earliest type, before the development of improved methods. It has not been found possible to identify the 'two clerks' who mention themselves in v. 1 as the authors of the poem.

(*University of Michigan*). LOUIS C. KARPINSKI.

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THE MANUSCRIPT. The versified Old French algorism here edited for the first time is contained in Ms. Selden Supra 26 (no. 3414 in the Summary Catalogue) of the Bodleian Library, Oxford. This volume is a collection of seven unconnected arithmetical and astronomical treatises, written on parchment by various hands in the late twelfth and the thirteenth centuries, probably in France. The French treatise is placed second, occupying folios 13-16; the remainder of the volume is in Latin, except for some French miscellanea on fo. 23. The size of the French manuscript is 18.8 by 12.5 cm.; the handwriting dates from the thirteenth century. Apart from the first seven lines, which are written as prose, and occasional overflows and insertions in the remainder of the text, it is written in columns of verse, two columns to a page, 34 to 37 lines to a column. The total number of verses preserved is 512; in the edition this has been increased to 519, owing to the necessity of allowing for verses to complete defective couplets. Fo. 16° v° contains only four lines of writing, the remainder of the page being left blank. In the first column of fo. 13 r° there are two large ornamented initials, L (v. 1) and S (v. 33), overlapping three and two lines respectively, both blue with red vignettes, and connected along the left margin by a series of red and blue strokes with flourishes; this is the only ornamentation.

CONTENTS. The treatise may conveniently be divided into twelve sections, viz. :

(9) *Rara Mathematica*, London, 1839 and 1841, p. 74, note.

I	a general introduction, explaining the necessity of learning arithmetic	(vv. 1-32)
II	on the place of arithmetic among the arts	(33-76)
III	on the origin of arithmetic, its subdivisions, the figures and their use	(77-146)
IV	progression, i. e. the writing of numbers	(147-180)
V	addition	(181-221)
VI	subtraction	(222-273)
VII	duplation	(274-305)
VIII	mediation	(306-327)
IX	multiplication	(328-381)
X	the inter-multiplication of digits	(382-425)
XI	division	(426-458)
XII	square root	(459-519).

The beginning of section II is indicated by a large initial; that of sections IV to IX, XI and XII by a paragraph sign in the margin. The first and the last three of these signs were written by the copyist or his corrector (see below); the remainder are probably by a different hand, which has also added rubrics to the left or right of vv. 181 (*Addicion*), 222 (*Sustracions*), 274 (*Duplaciuns*) and 306 (*Mediaciuns*).

THE SCRIBES. The condition of the text is in many ways unsatisfactory. The copyist did his work hastily and carelessly, apparently making little effort to understand what he was writing. It is clear that vv. 110, 173, 191, 319, 320, 327 and 424-5 (one line) have been omitted, the couplet as well as the sense being incomplete in each instance. There are certainly lacunae after vv. 336 and 339, while the passage 496-501 is entirely incoherent as it stands. Many other omissions may be suspected, but we have no means of judging their extent. In other instances it has been necessary to add words or letters to the text (all indicated by square brackets) in order to make it intelligible. Characteristic examples of the scribe's heedlessness and ignorance will be found in vv. 68, 102, 108, 157, 203, 206, 239, and many other lines. Fortunately a large number of his blunders can be rectified. A second writer, apparently contemporary with the first, has gone through the text and made corrections, in a manner which suggests that he was a master correcting the work of a careless pupil. Seeing that in nearly every instance the alterations improve

the grammar, regularize the metre, and give the sense required by the context, we may conclude that they are based on good authority — probably on a more careful reading of the manuscript which the first scribe was so inaccurately copying. That many of the corrections are by a different hand (possibly two hands) is clear from differences in the colour of the ink used (sometimes darker, more often lighter) and in the formation of letters. Various methods have been employed for making the corrections: words and letters have been expuncted, one letter written upon another, words or parts of words rewritten either above or (rarely) below the line, interlinear and marginal insertions added, etc. Sometimes the reading of the first scribe has not been expuncted or barred, but a second reading added above or beside it. Vv. 267, 268, 273 and 403 have been entirely rewritten, while vv. 224, 252, 396 and 397, all omitted by the first scribe, have been added in the margin. The necessity of disentangling these corrections, many of which could not be properly interpreted without a close scrutiny of the manuscript, has not lightened the task of editing the text; but their presence is a piece of good fortune, without which an edition worthy of publication could not have been produced. As it is, the corrector's attentiveness diminished towards the end of the text, with the result that certain portions of sections VIII-XII are obviously defective or barely intelligible. Only in vv. 7, 166, 284, 336, and perhaps 109, are there good grounds for rejecting readings introduced by the second writer. Alterations of all kinds found in the Ms., including corrections by the first scribe of his own errors, have been indicated in the footnotes as completely as possible. The first scribe has been designated A, the corrector B, wherever the two could be distinguished. When a variant is given as the reading of A, the reading adopted in the text is that of B, unless otherwise stated.

CONTRACTIONS. The contractions prevalent in French Mss. of the thirteenth century were freely used by copyist A; the expansion of them for the most part requires no explanation. As might be expected of so hasty and unmethodical a scribe, he sometimes used the same sign for two different purposes, or two different signs for the same purpose. In expanding the contractions it has been necessary to take into account the spelling of the same or similar words when written in full. Thus the sign 9 normally

represents *con* (e. g. *conpot* 2, *aconte* 13, *conme* 14, *connoist* 23) or *com* (9[e] = *come* 116), but *cun* in *aucun* 302, 307 (cf. *aucun* in full, v. 274, etc.) The bar over a nasalized vowel before a labial consonant has been interpreted as *n*, not *m* (e.g. *nonbre* 17, *unbre* 18, *resenblent* 102), in view of the spellings *enbrache* 119 and *nonbres* 149 (*nombre* 224 is due to B). The bar was inadvertently omitted by the scribe in *enpru[n]te* 244 and *enpru[n]ter* 251, and added incorrectly in *sāns* 60. A similar bar is used to represent *u* after another vowel; thus *mōt* 24, 240, *sōs* 52, *mōteploier* 329, etc., and *sōme* 482 have been interpreted as *mout*, *sous*, *mouteploier* and *soume* respectively, in view of the spellings *sous* 182, *soume* 342, *mouteploeras* 358, *multeploier* 366, etc., and the parallel contractions *vādra* for *vaudra* 245 (but cf. *vēdra* for *vaudra* 317) and *vōdras* for *voudras* 331. *Errāment* 277 may represent either *erranment* or *erraument*. The barred p represents *par* (e.g. *par* 16, *part* 37) and *per* (e.g. *pert* 27, *nonper* 313); it is wrongly used for *por* in *porra* 472, and conversely *p'* is used for *pro* in *prochene* 243 (corrected by B), 477, and *prochain* 487. The peculiar marks under *argorisme* in v. 4 are perhaps merely a method of underlining the word on its first occurrence. It should be added that, in the writing of copyist A, *n* and *u* are often indistinguishable.

VERSIFICATION. The metre employed is the ordinary Old French octosyllabic couplet. In a few instances the couplet principle has not been strictly observed. Three lines rime together in *-i* (vv. 101-3), five in *-és* (104-8), and five in *-ras* (249-53); but we are not justified in assuming that a line has been interpolated or omitted in each of these instances. Certain couplets which are palpably defective have already been mentioned. V. 85 has no line with which to rime, yet there is no sign of any gap in the sense. A small proportion of the lines, as presented by the Ms., do not possess the correct number of syllables. The corrections introduced by B have sometimes eliminated the metrical irregularities of A (e.g. in vv. 217, 264, 500 and 519), while in certain other lines corrections which restore the correct number of syllables are demanded by the sense (vv. 52, 77, 113, 138, 162, 231, 370). The remaining irregular lines could nearly all be restored to eight syllables by easy emendations, but such corrections have been relegated to the footnotes. Although it is highly probable that the careless scribe is responsible for the irregularities, the authors

themselves (whose skill as versifiers was not of a high order) were perhaps not incapable of sacrificing regularity of versification to the requirements of the subject-matter. The lines for which emendations have been suggested for metrical reasons are: (addition of a syllable) 7, 18, 60, 127, 164, 250, 298, 343, 355, 378, 442, 447, 455, 501; (omission of a syllable) 21, 76, 80, 158, 232, 241, 279, 296. It is less obvious what corrections should be introduced in vv. 87 (—1), 128 (—1), 134 (+1), 144 (—1), and 481 (—1).

Assuming that the work was composed in regular octosyllabic lines, we may note the following features in the counting of syllables. *Que* (pronoun and conjunction) normally undergoes elision before a vowel, but creates hiatus in vv. 3, 150, 196, 287, 293, 383, and 414. The vowel of *qui* is elided in vv. 55, 495 and 496 (?), and that of accusative *che* (from *ecce-hoc*) in vv. 354 and 433. *Se* 'if' undergoes elision except in vv. 7 and 292. *Si* (from Lat. *sic*) undergoes elision in v. 397. There is hiatus after *ne* 'or' in v. 426, and after a polysyllabic word in *figurẽ adente* 492. Internal vowels in hiatus are still intact (*seü* 51, *feïs* 227, *meïsme* 288, *roont* 402, *veïr* 414), except in *nient* 135-6. *Voir* 123 and *voier* 166 for *veoir* are probably corrupt (see the footnotes), while *veu* 495 probably has no connection with *veoir* (see the glossary).

The rimes are accurate, though occasionally obscured by the scribe's misspellings (vv. 2, 38, 52, 131, 159, 188, 303, 357, 441). The corrections introduced by B have improved the rimes in vv. 8, 68, 146, 223, and elsewhere. *Entre* : *trente* 157-8, ignoring *r* after a consonant (cf. *metre* : *amete* 332-3 A), is a normal Old French rime. *Meïsme* : *chifre* 288-9, a mere assonance, is perhaps corrupt. On rimes involving dialectal pronunciations see the following paragraph. The rimes are frequently leonine or rich. The authors did not shrink from riming a word with itself, sometimes with little or no difference of meaning (vv. 11, 65, 115, 135, 139, 181).

LANGUAGE. The text is written in continental French of the thirteenth century. A comparison of the forms of the manuscript with those assured by metre or rime leads to the conclusion that the scribe belonged to a considerably later period than the authors, and perhaps to a different region. The Ms. presents dialectal features which, though in no instance confined to a single province,

point to Picardy as the home of the scribe : *ch* for *c* before *e*, *i*, and yod (e.g. *ches* 42, *enbrache* 119, *tierche* 188, *esfaches* 378, *agenche* 408, *rachine* 506), confusion of intervocalic *s* and *ss* (*soufissent* 135, *truises* 254, 292), *s* written consistently for final *z* (e.g. *ars* 41, *piés* 105, *metés* 107), metathesis in *flabe* 159 and *mousterra* 482, the futures *saras* 175 and *aras* 509 without *v*, and *ceu* or *cheu* 3, 303, etc., as tonic form of *ço*, *ce*. Other dialectal traits, such as *muidres* for *mieudres* (= *meilleurs*) 144, the infinitives *voier* 166 and *veïr* 414, the substitution of *en* for *an* in *avent* 217, *vuil* for *vueil* 296, the feminine pronoun *lié* for *li* 342, the dropping of *i* between vowels in *mouteploëras* 358, 401, and *fïes* for *fiees* 443, are too isolated to serve as reliable evidence for localizing the scribe. None of the forms just mentioned can be attributed with certainty to the authors, while several (*flabe*, *voier*, *avent*, *truises*) are undoubtedly due to the scribe alone. In the rimes it is difficult to find anything which is not Central French. *L'en* : *rien* 145-6 may be a Picard rime in *ẽ*, or a Parisian rime in *ã*. The 1 pl. ending *-on* for *-ons* 46, 177, and the analogical subjunctive *mespraigne* 72, certified by rime in each instance, were widespread in northern France; while the analogical form *descrïent* 34 may have arisen in any area. The reduction of *ie* to *i* in *cri(s)me* (: *argorisme*) 8 — a development which occurs in Walloon, Norman, and other dialects besides Picard — and the somewhat doubtful *veu* (: *lieu*) 495 for *vuit* seem to be the only definite provincialisms.

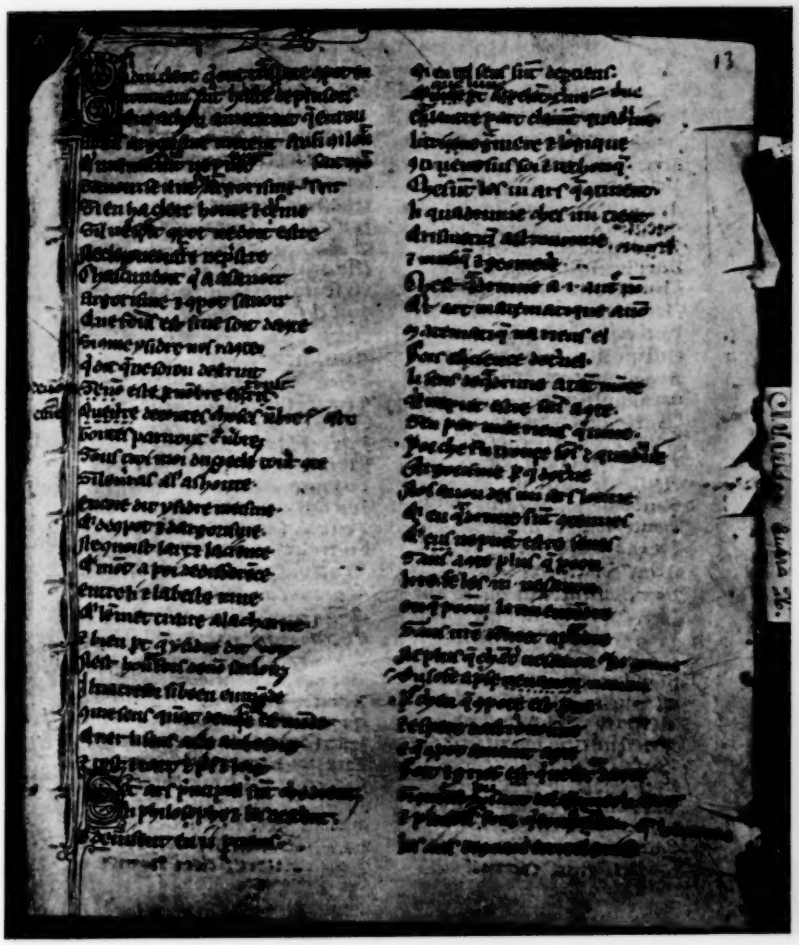
The divergence between the practice of the scribe and that of the authors appears to be due in several instances to phonetic and morphological developments which took place in the course of the thirteenth century. Thus the authors recognized the presence of *s* before a dental consonant, distinguishing *conpot* < *computum* (: *pout* 5) from *conpost* < *compositum* (: *apost* 171, etc.); whereas the scribe sometimes omitted *s* before *t* (*conpot* 151, 172, etc., *tanstot* 152, 419, *soutraire* 437). When followed by *m*, *s* may have been mute even in the language of the authors, cf. *argorisme* : *crisme* (for *crieme*) 7. Initial *c* (= *ts*) was confused with *s* by the scribe, e.g. *cïence* 23, *sifre* 210. The authors preserved internal vowels in hiatus, but the scribe reduced *veoir* to *voi(e)r* 123, 166, perhaps also *daërraine* (or *derreaine* ?) to *derrainne* 298, 355. It is not certain that the authors rimed *oi* with *ai*, the rime *lait* : *estoit* 219 being disputable; the scribe, however, substituted *ai*

for *oi* (*tai* 478, *mains* 392, 472) and *oi* for *ai* (*soit* 13, 273, *soustroi* 19, *foi* 210). The only infractions of the Old French declension rules which can be attributed with certainty to the authors, apart from proper names, technical terms, and nouns or adjectives used predicatively, are *li gregnor* nom. sg. 183 and *mendre* acc. 232; the scribe, on the other hand, frequently substituted the accusative form for the nominative (vv. 8, 11, 67, 71, 93, etc.). The scribe added analogical feminine *e* to *oële* 241 and *alantes* 441, and probably expanded *Quil* into *Qui le* 80. The absence of nominative *s* from *mestre* 79 is guaranteed by the metre as a feature of the original text.

I am indebted to Dr. C. J. ONIONS and Mr. A. EWERT for their kindness in reading the manuscript of the present publication and suggesting some improvements.

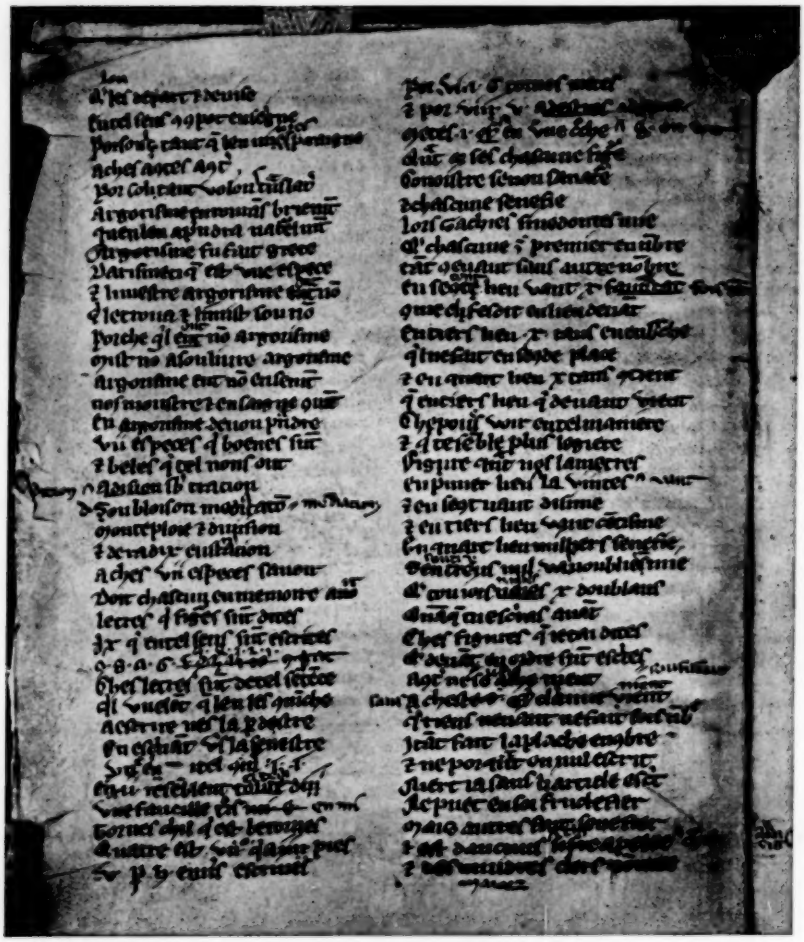
[I] Li dui clerc qui ont translaté Fo. 13 a
Conpot en roumans sunt hastés
De plusors que a cheu [s']ametent
Que en roumans argorisme metent,
Ausi con il ont fait conpot,
Que nul n'atint ne savoir pout
Se il ne seit argorisme.
Si en ha clerc honte et crisme,
S'il ne seit conpot; ne doit estre
Ne clerc ne diacre ne prestre.
Chascun doit, qui a a savoir,
Argorisme et conpot savoir;
Que fous est si ne soit d'aconte,
Si conme Ysidre nos raconte,
Qui dit : ' Que ne soion destruit,
Devon est[r]e par nonbre estruit.
Oste de toutes choses nonbre,
Toutes periront con unbre.
Soustroi moi du siecle tout conte,
Si le verras aler a honte '.
Encore dit Ysidre meïsme :
' Qui de conpot et d'argorisme
Ne connoist l'art et la cïence,
Que mout a poi de difference
Entre li et la beste mue
Que l'en met traire a la charue '.
Et bien pert que Ysidre dit voir;
N'est honte fors de nonsavoir.
Il n'a tresor si boen eu monde
Conme sens, quant de visde est monde;
Quer li sens aide au besoig
Et tost et tart et pres et loig.

[II] Set ars principal sunt, che dïent
Li philosophe, et les descrïent
Et devisent en .ii. parties,
Qui en tel sens sunt departies fo. 13 b
Que l'une part appelent trive,
Et l'autre part claiment quadruvie.
Li trive gramere et logique



A XIIIth. Cent. algorism in French verse (f. 131°)

Isis, xi, pl. 1 E. G. R. Waters.



A XIIIth. Cent. algorism in French verse (f. 13v°)

Isis, xi, pl. 2 E. G. R. Waters.

I. The two clerks who translated the computus into French are urged by many people to undertake the task of putting algorism into French, just as they did the computus, which no one ever grasped or could get to know without knowing algorism. A clerk suffers shame and fear, if he knows not the computus; he has no right to be a clerk or a deacon or a priest. Every man whose duty it is to have knowledge must know algorism and the computus; for he is a fool if he knows naught of reckoning, as Isidore tells us, who says : « In order to escape destruction, we must be instructed by means of numbers. Take away number from all things, and all will perish like shadow. Withdraw me all calculation from this world, and you will see it fall into shame. » Isidore himself says further : « If a man knows not the art and science of the computus and algorism, there is very little difference between him and the dumb animal that is put to draw the plough. » And it is very clear that Isidore speaks truth; there is no disgrace except from ignorance. There is no treasure in the world so good as intelligence, when it is free from cunning; for intelligence helps one at need, early and late, far and near.

II. There are seven principal arts, the philosophers say, and they describe and divide them in two parts, which are distinguished by their calling the one part trivium and the other part quadrivium. The trivium includes grammar, logic and rhetoric;

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2. *Final* s *of* hastés *added above line.* 3. *Ms.* ametetent. 6. *Ms.* p. sauoir; *A* puet. 7. seit *added by B, corr.* savoit ? 8. *A* crieme. 9. soit *corrected to* seit. 10. c *of* diacre *added above line.* 15-26. Per numerum siquidem ne confundamur instruimur. Tolle numerum in rebus omnibus, et omnia pereunt. Adime saeculo computum, et cuncta ignorantia caeca conplectitur, nec differri potest a ceteris animalibus, qui calculi nesciunt (*var.* nescit) rationem (*Isidore of Seville, Etymologiae, lib. III, iv,* 4, ed. *W. M. Lindsay, Oxford,* 1911, vol. I. 16. Senon *corrected to* Deuon; escrit *corrected to* estruit. 17. Oste] *A* Questre *corrected to* Estre. 18. *Ms.* pariront; con] *corr.* conme ? 19. *A* ciecle. 20. a] *Ms.* as. 21. *corr.* Encor ? 28. te *of* honte *added above line.* 30. *A* uise *corrected to* uice ; *the upper half of the letters* de *has been obliterated by a hole made in the parchment.* 35. *Ms.* partiens. 36. *Ms.* departiens. 37. Que nule *corrected to* Que lune; *A* triuie. 38. Eu *corrected to* Et. 39. trueue *corrected to* triue. 40.

Contient sus soi, et rethorique;
Che sunt les .iii. ars que contient.
Li quadruvie ches .iiii. tient :
Arismetique, astronomie,
Et musique et geometrie.
Chest quadruvie a .i. autre non,
Quer art matematique avon.
Matematique n'a riens el
Fors escïence dotrinel.
Li sens de quadruve a tant monte
Qu'il ne puet estre sans aconte
Seü par nule riens qui vive;
Por che fu trové sous quadruvie
Argorisme, par qui dotrine
Nos avon des .iiii. ars l'orine
Qui en quadruve sunt contenues,
Qui ne püent estre seües
Sans aconte, plus que poon
Lire se les .iii. ne savon,
Ou que poon latin entendre
Sans nostre Donnet aprandre,
Ne plus que chanter ne savon
Se game ou sofe apris n'avon.
Por cheu que conpot est partie
Et espece d'astronomie,
Et que conpot a maint aconte
Fort et grief, qui ne set d'aconte,
Si conme est li saut de la lune
Et plusors fois que l'on aüne
Les ans de grace en itel guise
Que l'on les depart et devise fo. 13 c
En tel sens con conpot enseigne,
Pour soul tant que l'en n'i mespraigne
A ches acontes aconter,
Por sol tant volons translater
Argorisme en romans briement,
Que l'en aprendra naturelment.
[III] Argorisme fu fait [en] Grece;
D'arismetique est une espece,

these are the three arts that it contains. The quadrivium comprises these four : arithmetic, astronomy, music and geometry. This quadrivium has another name, viz. the art of mathematics. Mathematics contains nothing else but theoretical knowledge. The quadrivium is of so difficult a nature that it cannot be known without reckoning by any living being; for this reason algorism was devised under quadrivium. By its teaching we have the basis of the four arts contained in quadrivium, which cannot be known without reckoning, any more than we can read if we do not know the three, or can understand Latin without learning our Donatus, or can sing without having learnt scales or notes. Because the computus is a part and subdivision of astronomy, and includes many a calculation which is difficult and irksome, if one knows not how to reckon — for instance the *Saltus lunae* and many occasions when the years of grace are assembled in such a manner that they are separated and divided in accordance with the teaching of the computus — for the sole purpose that no mistake may be committed in making these calculations, we wish to translate algorism concisely into French, which will be learnt without difficulty.

III. Algorism was made in Greece; it is a subdivision of

Contrueue *corrected to* Contient. 41. *Ms.* continent. 48. *Ms.* esicience, *first* i *expuncted*. 50. *Ms.* piet. 52. *Ms.* trouee; d *cancelled after* sous; i *of* quadruvie *added above line*. 56. i *of* Qui *above an erasure*; eus *cancelled after* Qui. 58. s *of* savon *expuncted*. 59. n *of* poon *corrected from* m. 60. *Ms.* Sāns; *Ms.* donneet, *corr.* Donatus ? 62. Se game *written at the end of* 61, *insertion marks by B indicate its proper place*; aprise *corrected to* -is; nen auon *cancelled before* nauon. 63. *A* Par; *A* conpote. 64. *Ms.* espere. 66. est *cancelled after* grief. 67. *A* v saut *corrected to* lui s. 68. s *of* fois *corrected from* t; *A* qui lont eue *corrected to* qui lon a uue. 70. lon *added by B*. 71. i *of* enseigne *added above line*. 72. sous *corrected to* soul; i mespraigne *corrected to* ni mesp. 74. sou *altered to* sol; s *of* volons *added above line*. 76. Quen *corrected to* Que; *corr.* Qu'en ?

Et li mestre Argorisme out non
Qui le trova et li mist son non.
Por che qu'il out non Argorisme,
Mist non a son livre ' argorisme ';
Argorisme eut non ensement.
Nos moustre et ensaigne conment
En argorisme devon prandre
.vii. especes, qui boenes sunt
Et beles, qui tel[s] nons ont :
Addition, subtration,
Doubloison, mediation,
Mouteploie et division,
Et de radix eustration.
A ches .vii. especes savoir
Doit chascun en memoire avoir
Letres, qui figures sunt dites,
.ix., qui en tel sens sunt escrites :
9. 8. 7. 6. 5. 4. 3. 2. 1.
Ches letres sunt de tel sentence
Qu'il vuelent que l'en les conmenche
A escrire ve[r]s la par[t] destre,
En escrivant vers la senestre.
Un es[t] itel conme .i. ' i ',
Et .ii. resenblent totedi
Une faucille; trois, enmi
Tornés, chil qui est betornés.
Quatre est un ' o ' qui a .ii. piés.
.v. par ' h ' envers escrivés.
Por .vi. .i. ' G ' tornés metés, fo. 13 d.
Et por .vii. .i. ' v ' adentés.
Metés .i. 8 en une croche,
. . . . . .
Quant or ses chascune figure
Conoistre selon sa nature,
Et [que] chascune senefie,
Lors sachiés, si ne doutés mie,
Que chascune est premier en nonbre
Tant come vaut sans autre nonbre.
En secont lieu vaut .x. fois tant

arithmetic, and the master was named Algorism who invented it and gave it his name. Because his name was Algorism, he called his book ' algorism '; it too was named algorism. He shows and teaches us how in algorism we must take seven operations, which are good and fair, bearing the following names : addition, subtraction, duplation, mediation, multiplication, division, and extraction of root. In order to learn these seven operations everyone must remember nine letters, which are called figures, written as follows : 9, 8, 7, 6, 5, 4, 3, 2, 1. These letters are of such a nature that they require to be begun on the right and written towards the left. One is like an ' i ', and two always looks like a sickle; three, which is indented in the middle, is like a pair of eyebrows placed sideways. Four is an ' o ' with two feet. Write five by ' h ' upside down. For six put a ' G ' turned round (*or*, a horned ' G '*?*), and for seven place a ' v ' face downwards. Put an eight (*or*, an egg*?*) in a hook, ... When you are able to recognize each figure according to its nature, and what each signifies, then know, and have no doubt, that each one when first in a number has just its own value without any other number. In the second place it is worth ten times as much as in the previous

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79. *A* eut. 80. *corr.* Quil *?* 81. *A* eut. *Line missing after* 84 *?* 88. *A* Adision. 89. Soubloison *corrected to* Dou-; *A* meditaton. 91. *A* eustation; *corr.* extration (us=x) *?* 96. *The figures* 5. 4. 3. 2. 1. 0, *written by A, were struck out by B, who inserted* 5. 4. 3. 2. 1. *above the line, after writing and striking out* 9. 8. 7. 6 (*?*) *at the end of the line.* 101. *Ms.* Vne, e *added above line*; en *corrected to* es. 102. En *corrected to* Et; *A* toute dui. 103. enmi] *A* mi e. 105. .0. *added above line*; .iiii. *corrected to* .ii. 107. *corr.* cornés *?* 108. .vii.i.] *Ms.* .viii., *corrected to* .vii.; *A* adestres. 109. 8] *A* of, *corrected by B to* 8 ou wit. 112. selon *Ms.* se non. 117. *A* seconte; *A* fauistant.

Conme el fesoit eu lieu devant.
En tiers lieu .x. tans en enbrache
Qu'il ne fait en seconde place,
Et en quart lieu .x. tans contient
Que en tiers lieu qui devant vient.
Che poués voir en tel maniere,
Et qui te senble plus legiere :
Figure, quant vos la metrés
En premier lieu, vaut unités,
Et en secont vaut disime,
Et en tiers lieu vaut centisme;
En quart lieu milliers senefie;
S'outre mil va, n'oublïer mie
Que toujors n'ailles .x. doublans
Quanque tu escriras avant.
Ches figures que je t'ai dites,
Qui devant en ordre sunt escrites,
A conter ne soufissent nient
Sans cheste : ' o ', qu'e[n] claime nient,
Qui riens ne vaut, ne fait fors unbre,
Itant fait [a] la plache enconbre,
Et neporquant en nul escrit
N'iert ja sans li article escrit;
Ne puet en soi fructefïer,
Mais autres fait senefïer;
Et est d'aucuns chifre apelee
Et des maiorz clers nonmee,
Mais par cifre l'apele l'en fo. 14 a
Mout plus que par nulle autre rien.

[IV] Or devon progression dire,
Qui t'aprandra nonbre a escrire.
Trois manieres de nonbres sunt
Que argorisme savoir font :
C'est doi, et article, et conpot.
Du doi vos voeill dire tanstot.
Doi est nonbre qui dedens .x.
Est contenu, si conm'est sis
Ou quatre ou .ix. ou .vii. ou .viii.
Article est nonbre issi dit

place. In the third place it embraces ten times as much as in the second place, and in the fourth place it contains ten times as much as in the preceding third place. You can see this in the following manner, which may seem easier to you : if you put a figure in the first place, it is worth units, in the second it is worth tens, in the third place hundreds, and in the fourth place it denotes thousands; if it goes beyond a thousand, on no account forget always to multiply by ten whatever you write in successive places. These figures which I have mentioned to you, written in their order above, are not sufficient for reckoning without this one : o, called naught, which is worth nothing, creates nothing but shadow, to such an extent does it encumber the ground, yet no article will ever be written in any work without it; of itself it can bear no fruit, but it gives significance to others; by some, including the clerks of greatest learning, it is called ***chifre***, but it is designated by the term *cifre* much more than by anything else.

IV. Now we must explain progression, which will teach you how to write numbers. There are three kinds of numbers which algorisms bring to our knowledge, viz. digit, article and composite. I will tell you forthwith about the digit. Digit is a number contained within ten, such as six, four, nine, seven, or eight. Article is

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118. eu *corrected to* el. 123. e *of* poués *added above line*; *corr.* Che pués veoir ? 126. vaut] *A* la. 127. *corr.* secont lieu ?; *corr.* disaines (*cf.* 157) ? 128. *corr.* centaines ? 130. S'outre] *A* Sen treus; *Ms.* vas, s *added above line*; *A* noublies. 131. n'ailles] *A* uaies. 135. soufissent] *A* so ache. 136. Sans] *A* A; *the* o *is obliquely barred*; *A* vient. 143. *A* sifre. 144. maiorz] *A* muidres. 145. par cifre] *A* fer fisie. 146. plus que] *A* quer ; *A* par nul autre non. 147. devon] *A* teuml, ml *corrected by B to* on; porgression *corrected to* prog- ; drre *corrected to* dire. 152. voeill] *A* uill ; *Ms.* tanstost, *second* s *expuncted*. 153. dis *expuncted before* .x. 154. conm'est] *A* conme ; sis] *A* vis. 156. nonbre

Qui tousjorns en disainnes entre;
Articles est .x. ou .xx. ou .xxx.
Et .xl. et nonbre sans flabe
Qui en disimes est finable.
Conpot est nonbre ensenble atret,
Qui de doi et d'article est fait,
Si conme .xi. et .xii. et .xiii.,
Et conme est chest nonbre : .xvi.,
Qui de .vi. et de .x. est dit;
Ce pouons voier sans contredit,
Car .x. est article par soi,
Et .vi. qui mains est a non doi.
S'auscuns veut aucun nonbre escrire,
Primes doit prandre, bien l'os dire, ...
Et ne li doit pas estre apost
S'il est d'article ou de conpot.
. . . . . .
De quel article ou de quel doi
Il est conpot; quant che saras,
Ton doi tout devant escriras.
Ton article, che te dison,
Metras aprés sans mesprison.
En tel sens con as oï dire
Doit chascun ches nonbres escrire.

[v] Addicion. Qui veut nonbre a nonbre ajoster,
Si doit l'un sous l'autre ajoster, fo. 14 b
Et doit estre escrit li gregnor
Desus et desor le menor,
Si que la figure premiere
Soit sous l'autre primeraniere.
Et seconde soit sous seconde,
Et tierche sous tierche responde.
Aprés conmenche en la part destre
A ajouster vers la senestre.
. . . . . .
Desous, si con il est droiture,
Ou l'autre desus la premiere.
Et puis esgardés la maniere
Du nonbre qui des deus vendra,

the term applied to a number which splits up entirely into tens. Ten, twenty or thirty is an article, forty also, in short any number which is divisible into tens. Composite is a number drawn together, composed of digit and article, such as eleven, twelve and thirteen, and like this number : sixteen, which is represented by six and ten; we can see this to be undeniably the case, for ten is an article in itself, and six which is less is called a digit. If anyone wishes to write a number, he must first, I venture to assert, ...; and he must not mind if it consists of an article or of a composite . . . . . of what article or of what digit it is a composite; when you know this, you must write down your digit in the first place of all. Your article, we tell you, you must put after it without fail. In the manner that you have heard explained everyone must write these numbers.

V. *Addition.* He who wishes to add one number to another must place the one close beneath the other, and the greater must be written above and over the smaller, in such a way that the first figure of the one is beneath the first figure of the other, and the second beneath the second, and the third corresponds beneath the third. Then begin adding on the right, working towards the left . . . . . beneath, as the right method is, with the other above the first. And then ascertain the nature of the number which results from the two, and be assured that

repeated at end of line. 157. *Ms.* Que; r *of* tousjorns *corrected from* u; disainnes] *A* .x. auunis, i *expuncted*; escrit *expuncted before* entre, entre *repeated above line by B.* 158. *corr.* Article *?*; o *of first* ou *added above line*, ou *repeated above line by B.* 160. *corr.* disaines *?* 162. est *added above line*; fait] *Ms.* atrait. 163. vi, *corrected to* xi, *perhaps by B*; *Ms.* xvii, v *expuncted*; vi *erased above* xiii. 164. *corr.* Et si conme *?*; s *expuncted before* xvi, *B repeated* xvi. 166. Ce] *Ms.* Se; pouons] *A* pous; *corr.* Ce pués veoir (*cf.* 123) *?* 167. par soi] *A* parst. 168. a] *A* en; doi] *A* de. 174. chest doi *corrected to* quel. 177. dison] *A* ron. 179. a *of* as *corrected from* t. 180. Soit *corrected to* Doit; ches] *Ms.* chet. 186. *Ms.* primemaniere. 187. soit *repeated.* 188. i *of second* tierche *added above line*; *Ms.* respont. 189. Et *expuncted before* Aprés. 195. des deus] *Ms.* dedens.

Et sachiés que il avendra
Qu'il soit doi, article, ou conpost.
S'il est doi, droit est que l'en l'ost
La figure desus, et fache
Autre figure en cele place
Qui vaille tant con il valoient,
Les .ii. qui devant i estoient.
Et si te convient acoster
D'article faire a l'ajouster,
Eu lieu desus cifre feras,
Et t'unité trespousseras,
Qui valoit .x., et si l'ajouste
Ou l'autre figure dejouste;
Et se de .ix. est la figure,
.i. sifre me foi a droiture,
Et t'unité avant joindras
O cele qu'enchiés trouveras.
S'encor t'avient a l'ajouster
Qu'a conpost t'esteuche acoster,
Lor escri eu lieu desus doi,
Et porte l'article par soi
Au lieu avent, ou en la guise
Que nos avon devant aprise.
Quant nule article onques ne lait fo. 14 c.
Remaindre eu lieu ou ele estoit,
Issi avras adiciun.

[VI] Sustracions. Aprés aprent subtracion.
Et se ve[u]s nonbre d'autre estrere,
Tu dois ton greignour nombre faire
Desus et desor le menor,
Tout autresi en tel tenor
Con feïs en adicion;
Quar nullui par subtracion
Ne puet, por riens qu'il puisse fere,
Grant nonbre de petit subtraire,
Mes le grant se puet bien est[reind]re
Et soufrir que l'en le fache mendre.
Et se veus soustraire, sor destre
Conmenche, et soustrai a senestre,

it will prove to be a digit, an article, or a composite. If it is a digit, one should remove the figure above it, and make in its place another figure worth as much as the two were worth which were there before. And if on adding it befalls you that you have to make an article, you must make a cipher in the place above, move your unit (which was worth ten) farther on, and add it to the figure next beside it; and if the figure is nine, make me a cipher in the proper manner, and you must join your unit with that which you find next after it. If further it befalls you on adding that you have to encounter a composite, then write a digit in the place above, and carry over the article alone to the next place, or in the manner that we have already taught [vv. 209-12]. When no article at all is left in the place where it was, your addition will be complete.

VI. *Subtraction.* Next learn subtraction. If you wish to take away one number from another, you must write your greater number over and above the smaller, in just the same way as you did in addition; for no one can by subtraction, whatever he may do, subtract a great from a small number, but the great can very well compress itself and allow itself to be made smaller. And if you wish to subtract, begin on the right, and subtract towards

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197. s *of* conpost *added above line.* 198. *omit second* l' ? 201. *A* vallent; *Ms.* valoit, e *added above* i. 203. si] *A* cil; te] *Ms.* tel, l *expuncted*; *A* aconter. 205. *A* sifre; ferons *corrected to* feras. 206. *A* Et tu ne te; trespasseras *corrected to* -pousseras. 214. *A* tẽnste aconter. 215. *A* Loresoi. 217. en *added by B.* 219. pres *expuncted before* nule; onques] *A* apres. 223. *A* estret. 224. *added by B in left margin.* 228. *A* nule. 230. Grant] *A* Si aut. 232. que l'en] *corr.* qu'en ?; *corr.* meindre ? 234. *Ms.* Conment che; *A* soustie. 235. *Ms.*

Et oste la basse figure
De cele desus a droiture.
Aucunefois ne la savras
Oster, quant egaux les verras,
Ou troveras cele desus
Mout menor que ceste dejus.
S'elle est oële, tu l'osteras
Et ton cifre iluec poseras.
S'il est menor, de la prochainne
Figure enpru[n]te .i. disaine :
Che sera un, qui .x. vaudra.
Ches .x. ajoster covendra
A la figure dedevant,
Mais che n'est mie en escrivant,
Mais en ton cuer la poseras.
Cele desor sereras,
Quant ton .x. enpru[n]ter devras;
[C]elle desous en soustreras.
Tele ore iert, cifre i troveras;
Et s'il avient que tu li truises
N'avoir en li qu'enprugter puisses,
Outre le chifre passeras,
A cele qu'enchiés troveras
Enprunteras une unité.
Et saches bien de verité fo. 14 d.
Que nule unité enpruntee
Ne porroit pas estre aportee
Par desous .i. chifre au soustrere
Sans faire de li novenere.
Quant a son liu [l']avras atrete,
Lors iert cele desous soustrete
Du nonbre que desus avras,
Et le remanant i leras.
Ajouster savras et soustrere,
S'isi con je te di ses faire.
Et saches que subtracion
Preuve l'on par adicion,
Et adicion par soustraire
Preu[v]e cil qui bien le soit faire.

the left, and take away the under from the upper figure in the proper manner. Sometimes you will not be able to take it away, when you see them equal; or you will find the upper figure much smaller than the lower. If it is equal, you must remove it and put your cipher there. If it is smaller, borrow a ten from the next figure, i.e. one, which will be worth ten. These ten must be added to the preceding figure — not, however, in writing, but you must set it down in your mind. When you have to borrow your ten, you must reduce (?) the upper figure; you will [afterwards] subtract the lower from it. Sometimes you will find a cipher there; if it does happen that you find it to contain nothing that you can borrow, you must pass beyond the cipher, and from the figure that you find next to it borrow a unit. And know for certain that no borrowed unit could ever be brought under a cipher, when one is subtracting, without making it into a nine. When you have brought it into its place, then the figure below must be subtracted from the number that you have above, and you must leave the remainder there. You will know how to add and subtract, if you can do as I tell you. And know that subtraction is proved by addition; and he who knows well how to do it proves addition by subtracting.

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ostee, *second* e *expuncted*; la] *A* de. 236. Se *corrected to* De. 237. la] *A* le. 238. *A* egaus; s *of* les *added above line*. 239. *Ms.* Outre uerras. 241. *A* Cele est; *corr.* oël ? 242. *A* sifre; *A* poteras. 243. *A* cil; *A* p'chene. 245. un] *Ms.* vii; *A* vādra, *B* vaudra. 246. i *of* aioster *corrected from* n. 247. A] *A* Ou. 249. *added by B*. 250. *corr.* resereras ? 252. *added by B in left margin, first letter rubbed away* ; *omit this line* ? 253. Cele *corrected to* Tele ; *A* sifre. 254. s'il] *A* cil. 255. N'avoir] *Ms.* Naura. 256. Outre] *Ms.* Entre. 263. A nouere. 264. liu] *A* li ; atrete] *A* streste. 265. *A* Lor ; soustrete] *A* son estre. 267. *A* A le remanant illerras. 268. *A* Ne oster sauras ne son estre. 270. *A* siches. 271. Preuve] *A* Prangne. 273. *A* Por quoi uequit

[VII] Duplaciuns. Qui veut aucun nonbre doubler
Les figures doit assenbler
En une ligne soulement,
Et doit conmenchier erranment
A doubler l'ultisme figure.
Et se cel double est de tel nature
Que son nonbre dedens .x. soit,
La soit mise ou l'autre estoit.
Et se .x. avient au doubler,
Ne te dois de cheu controubler,
Mes pur le .x. cifre feras,
Et [t'] unité avant metras.
Et se ton nonbre outre .x. va,
Pran cheu que outre .x. sera
Et le pose en cel lieu meïsme.
Les .x. qui remaignent sans chifre
Par figure dun poseras
Arriere, et si l'ajosteras
Ou autre, se illuec la truises,
Por che que ajoster la puisses;
Et si iras en descendant
Chascune figure doublant.
Et encore te vuil anonchier fo. 15 a.
Qu'a doubler doit l'en conmenchier
A la figure desrainne
En alant vers la premeraine,
Quar qui la premiere voudroit
Doubler primes, li convendroit
Aucun nonbre doubler .ii. fois;
Por ceu que conmenches, ch'est droit
A doubler cele de derriere,
Et double au derrain la premiere.
[VIII] Mediaciuns. Se tu te veus avoisdïer
A aucun nonbre medïer,
A la premerainne figure
Dois conmenchier, que c'est droiture;
L'une moitié en osteras,
Et l'autre moitié i metras.
En tous les sens fors [e]u premier

VII. *Duplation.* He who wishes to double a number must collect the figures in a single line, and must forthwith begin doubling the last figure. If that double is of such a nature that its number is less than ten, let it be placed where the other figure was. And if the doubling produces ten, you must not be disconcerted at this, but for the ten make a cipher, and put your unit in front. And if your number exceeds ten, take the excess over ten and set it down in that same place. You must then by means of a figure put backwards [i.e. on the left] the remaining ten, without the cipher, and set it against another figure, if you find one there, in order that you may add it; and you must go down the line, doubling each figure. I would also point out to you that in doubling one must begin at the last figure [i.e. on the left] and work towards the first, for if one wished to double the first first, one would have to double some number twice; in order to (?) begin, it is correct for you to double the last figure first, and you must double the first last.

VIII. *Mediation.* If you would acquire skill in halving a number, you must begin at the first figure [on the right], for this is the proper method; you must take away one half from it, and put the other half there. In all positions except the first

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bien le sais faire. 275. O *expuncted before* les. 277. *or* erraument. 278. *Ms.* luitisme. 279. *omit* Et ?; de *added by B.* 281. *Ms.* lautre soit. 282. avient] *A* en vient. 284 x] *A* v, *corrected by B to* xx, *and* vint *in right margin*; *A* sifre. 285 *or* Et [l']unité ? 286. outre] *Ms.* entre. 287. x *added by B.* 288. cel] *Ms.* cil. 294. Et *added before the line*; *corr.* Issi ? 296. *corr.* encor ?; te *added by B.* 298. deraine *altered to* desrainne, *corr.* daerraine *or* desreaine (*cf.* 355) ? 299. *A* aler. 302. nonbre] *A* m̄bre; doubler] *A* dauoir. 303. que] *corr.* quant ?; s *of* conmenches *added above line*; est *added above line by B after* chest; *corr.* drois (*cf.* 337, 481) ? 304. de *added by B.* 305. *A* derrier. 306. te] *Ms.* ten; *A* aueoisdier, *first* e *expuncted*, voisdier *added above line by B.* 307. A] *A* En; *A* mendeier. 308. *A* premere. 309. Dois] *A* Du. 310, 311. *A* metie.

Dois nonper nonbre medeier
En tel sens : .i. en dois oster,
Et la metié illuec noter.
Cele unité que osté avras,
Quant .x. vaudra, mipartiras;
A la moitié de .x. ch'es[t] .v.
. . . . . .
. . . . . .
Et l'autre rejoig en la ligne
Que primes trouveras vers destre.
Lors seras de medïer mestre.
Et si t'estuet un departir,
En son lieu dois cifre gerpir,
Et .i., ch'est la moetié de li,
. . . . . .
[IX Multiplicaciuns.] Se tu veus ton sens enploier
En aprandre a mouteploier,
Escri tout ton nonbre premier
Que tu voudras mouteploier;
Et par desus l'un l'autre met
Qui a mouteploier s'amet,
En tel sens que la premeraine
Figure soit sous la derroenne
De cheu que mouteploier dois .... fo. 15 b
A mouteploier, quer ch'est drois,
L'ultime figure desus
Par l'ultisme du nonbre jus ....
Et tantes fois la conteras,
Et desus unités avras.
La soume qui de lié vendra
Asoer la te covendra
Sus la figure derraene,
Qui de mouteploier se painne.
Se ta multiplicacion
Te fait d'article mencion,
Escri sor le mouteploiant
.i. cifre, et met l'article avant.
S'il avient a mouteploier
Qu'a conpot t'estueche apoier,

[on the right] you must halve an odd number in the following manner : you must take away one from it, and write down the half there. You will divide that unit which you have taken away into two parts, when it becomes worth ten; half of ten is five . . . . . and transfer the other to the line that you find next on the right. Then you will be expert in halving. And if you have to divide one, in its place you must leave a cipher, and one (?), i.e. half of it . . . . . .

IX. ***Multiplication.*** If you wish to employ your wits in learning to multiply, first write out your whole number that you wish to multiply; and one who undertakes to multiply places the one above the other in such a manner that the first figure [of the multiplier] is beneath the last of that which you have to multiply . . . . . [Begin] to multiply the last of the upper figures by the last of the lower number, for that is the right method . . . . . and you will count it so many times, and above you will have units. You must place the total which comes from it over the last figure, when you are striving to multiply. If your multiplication results in an article, write a cipher over the multiplier, and carry forward the article. If it comes to pass in multiplying that you have to encounter a composite, you must

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312. sens] *corr.* lieus ? 313. *oblique bar after* nonbre. 317. vaudra] *Ms.* vendra. 321. *A* leioig. 322. Que] *Ms.* Qui. 323. *Ms.* mesdier, s *expuncted.* 324. un] *Ms.* vii. 325. *A* sifre. 326. i] *corr.* ½ ? 330. tout ton] *A* tou. 332. met] *Ms.* metre. 333. *Ms.* samete. 336. *A* Se cheu, *corrected by B to* Sur chen. 338. *A* Li vitisme. 339. *Ms.* luitisme. 341. unités] *A* uitismes. 343. *corr.* Aseoir ? 344. *corr.* Desus ? 345. *A* pene. 348. *Ms.* Escrit, t *expuncted.* 349. l'article] *Ms.* la tierche. 351. *A* testuet.

Sous le moutepleant ton doi
Metras, et l'article avant toi.
Quant ch'avras fait, repren t'alainne,
Mouteploie la derrainne
Par la penultime autre fois
Du moutepleant, quer ch'est droit.
Encor la mouteploëras
Par totes cheles que verras
Qui seront eu moutepleant.
Quant avras issi fait, a tant
Les figures remüeras,
Multepleanches i feras
Que la prime multepleance
Soit sous la peleultisme estance.
Puis dois multeploier arriere
La figure endroit la premiere,
Qui desus la premiere est mise,
Et la mouteploie en tel guise
Con tu feïs cele dejouste.
Le nonbre, quant vendra, ajouste
Ou l'autre nonbre, si verras
Sour cheu dont mouteploié as. fo. 15 c
Et pran bien garde et i met cure,
Quant avras aucune figure
Mouteploié par la premiere,
Qu'a mouteploier est maniere
Que chele desus esfaches,
Et en chel lieu le nonbre faches
Qui t'avendra de l'action
De la multiplicacion.
[x] Aucune fois te ravendra
Que aucun grant doi covendra
Mouteploier par li meïsme.
Issi l'ensengne l'argorisme,
Et garde ne te soit ennui :
De conbien .x. est plus de li
Cele difference osteras
Du doi, et devant la metras,
Et la mouteploie par soi.

put your digit beneath the multiplier, and carry forward the article. When you have done this, recover your breath, then multiply the last figure [of the multiplicand] over again by the penultimate figure of the multiplier,for that is the correct procedure. You must multiply it also by all those figures which you will see to be in the multiplier. When you have done so, you must then shift the figures, and make multiplications among them in such a way that the first multiplication is beneath the penultimate position. Then you must go back and multiply the figure against the first, that which is placed over the first, and multiply it in the same manner as you did the one beside it. Add the number, when it is obtained, to the other number, and on doing this you will see what your multiplication amounts to (?). And be mindful and careful about this, that when you have multiplied a figure by the first, it is the proper procedure when multiplying to efface the figure above, and to write in its place the number which you obtain by the act of multiplying.

X. Sometimes it will also befall you that a large digit must be multiplied by itself. The method taught by the algorism — beware of finding it irksome — is as follows : take away from the digit the difference by which ten exceeds it, put it in front [i.e. to the right of the digit], and multiply it by itself. Thus

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354. *A* talaine. 355. *A* derroene, *cf.* 298. 356. *A* peleultisme. 357. *corr.* drois (*cf.* 303) *?* 364. Que] *Ms.* Qui. 370. *Ms.* fais. 372. si] *A* il. 373. *A* Sor. 374. *Ms.* gardae, *second* a *expuncted*. 378. *corr.* dedesus *or* de desus (*cf.* 304)*?*; *Ms.* esfachies, i *expuncted*. 381. *Ms.* multiplicacōn. 383. tauendra *corrected to* cou-.

Essi mouteploie l'on doi,
Que riens ne mains ne plus n'i a;
Che saches *verbi gratia*.
Se savoir veus et estre enduit
Conbien font .viii. fïees .viii.,
Ce pués savoir par tel sentenche :
Soustrai [l]es .viii.; s'a differenche
Qui est entre les .viii. et .x.,
Che sunt .ii.; lors remaignent .vi.
Les .ii. devant les .vi. metras,
Issi les mouteploëras.
Les .vi. et les .iiii. en roont
Soisante .iiii. te feront.
Se .i. doi mouteploie autre doi,
Esgarde bien chascun par soi,
Et puis soustroi du doi greingnour
La difference du menor;
Et puis mouteploie et agenche
L'une par l'autre difference. fo. 15 d
Issi fere le covendra .
La soume qui des deus vendra
Soit devant la figure mise
Dont la difference fu prise,
Puis pués veïr que il i a.
Che voies *verbi gratia*.
Par .viii. fois .vii. se veus savoir
Que la soume d'eus puet avoir,
La difference du menor
Soustrairas tanstot du greignor;
Lor avras .v. por remanant.
Et fai conme je di[s] devant,
Et a mouteploier conmenche
.ii. par .iii.; par tel difference
Avras .vi. . . . . .
. . . . . et ch'iert l'onsisme.

[XI Divisiuns.] S'aprandre veus ne aviser
Nonbre par autre deviser,
Le devisant nonbre escriras
S[o]us cel que tu deviseras.

does one multiply a digit, and there is nothing more or less in the matter. An example will make this clear. If you wish to know and be instructed what eight times eight amounts to, you may ascertain it in the following manner : subtract the eight [from ten]; there is a difference between eight and ten, viz. two; then there remains six. You must put the two in front of the six, and multiply it [the two] [by itself]. The six and the four combined will give you sixty-four. If a digit multiplies another digit, examine each well separately, and then subtract from the greater number the difference of the smaller [from ten]; then multiply accurately the one difference by the other. That is how you must do it. Let the total resulting from the [multiplication of the] two be placed in front of the figure from which the difference was deducted, then you can see what the answer is. An example will illustrate this. If you wish to know what is the total resulting from eight times seven, you must forthwith subtract from the greater the difference of the smaller [from ten]; then you will have five left. Do as I said before, and begin to multiply two by three; when the difference [from ten] is of this amount, you will get six . . . . . and it will be the eleventh (?).

XI. *Division.* If you wish to learn or comprehend how to divide one number by another, you must write the dividing number beneath that which you are going to divide. Bring the

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391. lon] *A* du. 395. fiees .viii.] *A* si a difference. 396-7. *added by B in left margin.* 398. x] *Ms.* vx. 399. *Ms.* remaignant. 403. *A* Sus autres iiii te feront. 404. autre] *Ms.* entre, e *corrected to* a. 406. *Ms.* Et puis le soustroi, Et *expuncted*; *A* greingos. 408. *first* e *of* agenche *corrected from* o. 411. des deus] *Ms.* dedens (*cf.* 195). 417. d'eus] *A* done et. 420. por *struck out before* v. 421. *or* j'ai dit?

Ta figure derrainne maine
Ou devisé sous la derrainne
Du nonbre que dois deviser.
Et ch'estuet aprés aviser,
Savoir, se l'en purra[s] soustraire.
S'il avient que ne puisse[s] faire,
Sous la peleultime la met.
Aprés a soutraire te met
L'ultisme figure dejus
Du nonbre qui sera desus
Tante fois que par autretans
Repuisses les devant alantes
Du nonbre desus oster;
Et les fïes dois noter
Desus la figure premiere
Du devisant, en tel maniere fo. 16 a
Que se tu .iiii. fois soutrais,
Quatre fois desus portrais,
Se .ix. fois soustrais, .ix., et pose
D'autre soustraire te repose,
Quar autre .ix. ne pués soutraire.
Et quant or savras issi faire,
Tes figures remüeras,
L'une aprés l'autre poseras,
Et deviseras en la guise
Que tu as devant aprise.
Sans deviser ne pués soustraire
Nule fois. Issi t'estuet fere
Le nonbre ou les fois sunt escrites.

[XII Quadraciuns.] Or t'ai les .vi. espeses dites.
Or repués quarreson aprandre,
Mais il i estuet mout entendre.
Se revues d'aucun nonbre traire
La raïz, issi le pués fere.
Esgarde premier s'est nonper
Des figures le nonbre, ou per.
S'il est per, s[o]us la peleultisme
Poseras ta figure prime.
S'il est nonper, lors te repose,

last of your figures in the divisor beneath the last of your dividend. Next you must consider this, namely whether you will be able to subtract it from the figure above. If it happens that you cannot do so, put it beneath the penultimate figure. Then begin to subtract the last figure below from the number above so many times that on each occasion you can take away the preceding numbers also from the number above ; and you must write down the number of times above the first figure of the divisor, in such a manner that if you subtract four times, indicate four times above, if nine times, nine, and for a while desist from any further subtracting, for you cannot subtract another nine. When you have learnt how to do thus, you must shift your figures, place them one after the other, and divide in the manner that you have already learnt. You cannot on any occasion subtract without dividing. In this way you must make up the number in which the times are written.

XII. *Square Root.* Now I have explained six of the operations to you. Now you may learn square root in its turn, but it requires close attention. If you wish next to extract the root from a number, you can do so as follows. Consider first if the number of the figures is odd or even. If it is even, you must place your first figure beneath the penultimate. If it is odd, then do not do so, but under the

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431. *corr.* devisant *or* deviseur ? 438. *Ms.* Litiusme, s *added above line*; *Ms.* deuise, *second* e *expuncted*. 441. t *of* devant *altered to* s; *corr.* alans ? 442. *corr.* dedesus ? 443. *corr.* fiees ? 445. Du] *A* De. 447. *corr.* dedesus ? 448. Se ix *barred*, se .9. *written in margin by B*. 455. *corr.* dedevant ? 458. Le] *Ms.* El. 459. vi] *Ms.* vii. 460. *or* carreson ?, *Ms.* larreson. 463. La raïz] *Ms.* Lairas. 464. s'est] *A* chest. 467. *Ms.* primes.

Mais [sous] l'ultisme tele pose
Qui menee par soi tantost
Tout le nonbre desus en ost,
Ou [au] mains tant conme ele porra;
Et quant cele desus sera
Ostee, maintenant la quasse.
Double aprés la figure basse,
Et vers la destre par[t] la maine,
Et la pose s[o]us la prochene.
Aprés resoit par tai posee
Tel figure aprés la doublee
Qui la mouteplit une fois,
Et soi aprés, quer ch'est drois; fo. 16 b
Et la soume qu'il mousterra
Desus au nonbre osté sera.
La figure qui est posee
Aprés, si soit par toi doublee;
Et bien saches que ele doit estre
Posee eu prochain lieu vers destre.
Chascune figure posee
Devant atrei vers la doublee;
Et s'ilec treuves unité
Qui viengne de duplicité,
Yccele figure adente
La figure que est precedente;
Et si la pose eu premier lieu
Qu'aprés ches figures iert veu.
Tel figure que est precedente
Et en soi a tel sens adente . . . .
Quer le nonbre desus tantost
Tout autant con en porra ost . . . .
Des figures en tel maniere,
Tout sans müer la premiere, ...
Le nonbre ou riens ne remaindra
Desus cele quarte sera,
Et s'il i met aucune chose,
A une part par soi le pose.
Quant ta rachine traite aras
Issi, aprés medïeras

last figure set one which when multiplied by itself will forthwith take away the whole of the number above it, or at least as much as it can; and when the figure above is taken away, cancel it at once. Next double the under figure, move it towards the right, and place it under the next. Then see that you place after the doubled figure another which will multiply it once [without exceeding the number above], and itself as well, for that is the correct procedure; and the total that results [from its multiplying the doubled figure and itself] must be taken away from the number above. Next double the figure which is placed after; and take note that it must be placed in the next position on the right. Draw towards the doubled figure each figure that is put in front; and if you find it [i.e. the doubled figure] to contain a one as a result of the doubling, that figure [i.e. the one] overthrows [i.e. increases by one] the preceding figure; put it then [i.e. the added figure, without the one] in the first place that is vacant after these figures. Overthrow any figure which precedes and is of such a nature (?) . . . . . that it may forthwith take away the number above, so far as it can . . . . . of the figures in this manner, without altering at all the position of the first . . . . . The number in which nothing remains will be above that fourth figure, and if there is any remainder (?), place it on one side by itself. When you have thus extracted your root, you must next halve your under number,

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469. *Ms.* liuitisme. 472. *corr.* el ?; porra] *Ms.* ꝑra (=parra ?) 476. *or* l'amaine ? (*but cf.* 430). 477. *Ms.* p'chene. 478. Et *expuncted before* Aprés. 479. Tel] *A* cele; *final* e *of* doublee *added by B.* 480. *A* mouteploier. 481. *Ms.* soit. 485. Et *expuncted before* Aprés; soit] *A* doit. 487. *Ms.* p'chain. 489. *A* ratroi, r *expuncted.* 490. *A* Et cil est troues; *Ms.* vnites. 491. *A* maigne. 493. que] *Ms.* qi *corrected to* q̄. 495. *Ms.* veue. 496. *Ms.* precedentes. 497. *Ms.* atendes *corrected to* adentes. 498. *corr.* Que ? 500. *A* en maniere. 501. *corr.* remüer (*cf.* 362, 452) ? 504. i met] *corr.* i maint *or* remaint ? 506.r

Ton bas nonbre sans la figure
Premiere, et saches a droiture
Que icel bas nonbre iert la raïz;
Et ne soies pas esbahis.
Se veus prover se bien as fet
Et ta rachine en droit se trait,
Mouteploie la maintenant
Par soi, et che que est remanant
De la quadracion ajouste
O tel nonbre; par itel jouste fo. 16 c
Verras le nonbre, si te haite
Se a droit ta raïz as traite.
Explicit.

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of traite *corrected from* a. 509. *A* premier; *Ms.* sachies. 510. *Ms.* Que ii cel; z *of* raïz *added by B.* 515. *A* Pra. 516. *Ms.* Dae, a *expuncted.* 519. *Ms.* Et se; *Ms.* adroite, e *expuncted*; *A* taras atraite.

omitting the first figure [of each pair], and be well assured that that under number will be the root; and do not feel bewildered. If you wish to test whether you have calculated properly and your root is correct, multiply it forthwith by itself, and add to the resulting number what is left over from the quadration; on putting them together thus, you will see the [original] number. Then be joyful, if you have extracted your root correctly. Explicit.

WORD-LIST.

[References are given for all technical terms, for words, meanings and phrases of lexical interest, and for a few words and forms requiring special explanation. Square brackets indicate that an emendation has been introduced. An asterisk indicates that the word or meaning is not mentioned in the dictionaries of Tobler-Lommatzsch (down to *co-*) or Godefroy (from *co-*).]

aconte, *sm.* reckoning, calculation 13, 50, etc.
aconter, *v.a.* 73.
acoster, *v. refl.* (+ *a*) come close to, encounter 214; (+ *de* and inf.) 203; cf. *apoier*.
addition 88, *adiciun* 221, *-ion* 227, *sf.*
adenter, *v.a.* put face downwards, overturn 108, 492, 497.
agenchier, *v. a.* set in order 408.
ajoster, *-ouster*, *v. a.* (+ *a*) place next to 182, (+ *ou*) do. 291; add 181, 190, etc.
**ametre*, *v. refl.* (+ *a*) set oneself to, undertake [3], [333]; Godefroy gives a single example of this use, but constructed with *de*.
anonchier, *v.* 296.
apoier, *v. refl.* (+ *a*) come close to, encounter 351.
**apost*, *adj.* unpleasant, disagreeable (= *empost*) 171.
argorisme, *sm.* 4, 7, 53, 150, etc.
arismetique, *sf.* 43, 78.
**article*, *sm.* number completely divisible by ten 140, 151, 156, etc.
asoer = *as(s)eoir*, *v. a.* 343.
astronomie, *sf.* 43, 64.
atint, *pret.* 3 *sg.* of *atenir*, *v. a.* attain, grasp, comprehend (confused with *ataindre* cf. Tobler-Lommatzsch, I, col. 635) 6.
atrei, *imperat.* 2 *sg.* of *atraire*, *v. a.* 489.
aüner, *v. a.* assemble 68.
**autretans*, *adv.*; *par a.*, an equal number of times 440.
**avoisdïer*, *v. refl.* (+ *a*) acquire skill in 306.

betorner, *v. a.* turn the wrong way 104.

**centisme*, *s.* a hundred 128; an error for *centaines* ?
chifre 143, 256, 262, 289, *cifre* 145, 242, etc., *sifre* 210, *sm.* cypher, ngught.
chil, *sm.* pair of eyebrows 104.
cïence = *sc̈ience*, *sf.* 23; cf. *esc̈ience*.
conpost, *-ot*, *sm.* composite number consisting of article and digit (Lat. *compositum*) 151, 161, 197, etc.

conpot, *sm.* explanation of ecclesiastical calendar (Lat. *computum*) 2, 5, 9, 22 63, 65, 71.
controubler, *v. refl.* 283.
crisme, *s.* fear 8.
croche, *sf.* 109.

dejouste, *adv.* 370.
dejus, *adv.* 240, 438.
departir, *v. a.* [36], 324.
descrïent, *ind. pr.* 3 *pl.* of *descri(v)re*, *v. a.* 34.
devisant, *pres. p. as adj.*; *le d. nonbre*, the divisor 428; *sm.* divisor 445.
**devisé*, *sm.* divisor 431; corr. *devisant* ?
deviser, *v. a.* divide 35, 427, etc.
**disime*, *s.* ten 127, 160; an error for *disaine(s)* (*cf.* 157, 244) ?
division, *sf.* 90.
**doi*, *sm.* digit 151, etc.
dotrine, *sf.* 53.
dotrinel, *adj.* theoretical 48; cf. Lat. *scientia doctrinalis* (Isidore, quoted by Lewis and Short).
double, *sm.* 279.
doubler, *v. a.* 274, etc.; *dis d.*, increase tenfold (corr. *par dis* ?) 131.
**doubloison*, *sf.* 89.
duplicité, *sf.* doubleness 491.

enchiés, *adv.* 212, 257.
enconbre, *sm.*; *faire* [*a*] *la plache e.* 138.
endroit, *prep.* next to, against 367.
enduire, *v. a.* teach 394.
escïence, *sf.* 48.
esfachier, *v. a.* 378.
espece [64], 78, 86, 92, *-ese* 459, *sf.* subdivision, (arithmetical) operation.
estance, *sf.* 365.
esteuche 214, *estueche* 351, *subj. pr.* of *estovoir*, *v. impers.*
estrere, *v. a.* take away 223.
[*estreindre*], *v. refl.* 231.
eustration (*de radix*), *sf.* 91; corr *extr-* ?

faucille, *sf.* 103.
fïee 395, *fïe* 443, *sf.* time.
figure, *sf.* 94, etc.
finable, *adj.* capable of ending, divisible 160.
flabe = *fable*, *sf.* 159.
foi, *imperat.* 2 *sg.* of *faire* 210.
fructefïer, *v. n.* 141.

game, *sf.* gamut, scale 62.
geometrie, *sf.* 44.
gramere, *sf.* 39.

haitier, *v. refl.* 518.
haster, *v. a.* 2.

jouste, *sf.* juxtaposition 517.

logique, *s.* 39.

maine, *imperat.* 2 *sg.* of *mener*, *v. a.* 430, 476.
matematique, *adj.*; *art m.* 46; *s.* 47.
mediation, *sf.* 89.
medïer 307, 323, 507, *-eier* 313, *v.a.*
mencion, *sf.*; *faire m. de* 347.
**mener*, *v. a.* multiply 470; similarly in the algorism published by V. MORTET (Bibl. Mathematica, 3d series, 9, 1908), p. 62 : *li digis soit menés en soi cubement* (Lat. *ducatur in se*); cf. Eng. *lead* (New Eng. Dict.).
mespraigne, *subj. pr.* 3 *sg.* of *mesprendre* 72.
mesprison, *s.* mistake 178.
metié = *moitié*, *sf.* 315.
mipartir, *v. a.* 317.
monter, *v. n.* amount 49.
**mouteploiant* 348, *-pleant* 357, 360, *sm.* multiplier.
**mouteploie*, *s*(*f*?) multiplication 90.
mouteploier 329, etc., *-ploër* 358, 401; *subj. pr.* 3 *sg.* *-plit* 480 : *v.*
multepleanche 363, *-ance* 364, *sf.*
multeploier, *v. a.* 366.
multiplicacion, *sf.* 346, 381.
musique, *s.* 44.

naturelment, *adv.* easily (?) 76.
nient, *sm.* naught 135.
nonper, *adj.* odd 313, 464, 468.
nonsavoir, *sm.* 28.
novenere, *adj.* consisting of nine units; *used as subs.* 263.

oël, *adj.* equal 241; cf. *egaux* 238.
of, *sm.* egg 109 A.
orine, *s.* origin 54.

par, *prep.*; *p. soi*, independently, separately 167, 216, 405, 470.
penultime 356, *peleultisme* 365, 466, *-ime* 436, adj.
per, *adj.* even 465, 466.
philosophe, *sm.* 34.
portraire, *v. a.* indicate 447.
pose, *adv.* for a while 448.
precedent, *adj.* 493, 496.
*[*primeranier*], *adj.* first 186.
principal, *adj.* 33.
progression, *sf.* 147.

**quadracion*, *sf.* 516.
quadruvie, 38, 42, 45, 52, *-uve* 49, 55, *sm.*
*[*quarreson*], *sf.* squaring 460; cf. *quadracion*.
quasser, *v. a.* cancel, suppress 474.

rachine, *sf.* 506, 513.
raïz, *sf.* 463, 510, 519; cf. *radix* (Lat.), 91.
remaindre 220, 502; *ind. pr.* 3 *pl.* *-aignent* 289, [399]; *pres. p.* *-anant* 515 : *v. n.* be left; *pres. p. as subs.* remainder 420.
remüer, *v. a.* change about 362, 452; cf. *müer* 501.
reposer, *v. refl.* cease, stop 449, 468.
respondre, *v. n.* correspond 188.
rethorique, *s.* 40.
roont, *adj.*; • *en r.*, taken together, in conjunction 402.
roumans 2, 4, *rom-* 75, *sm.* the vernacular, French.

saut (*de la lune*), *sm.* 67; cf. Beda, De Temporibus (in Migne's Patr. Lat., xc), cap. xii, De Saltu Lunae, and Philippe de Thaün, Cumpoz, ed. Mall, vv. 2345 ff.
savoir, *inf. as conj.* to wit, namely 434; cf. W. Foerster, note to Crestien's Lancelot, v. 2846.
sens, *sm.* intelligence 30, 31, 328; manner 36, 71, 95, 179, 314; nature 49 (?), 497 (?); position 312 (?).
sentence, *-enche*, *sf.* nature 97; manner 396.
•*serer*, *v. a.* reduce (?) 250; corr. *resereras* ?
•*sofe*, *s.* sol-fa, notes of music 62.
soit, *ind. pr.* 3 *sg.* of *savoir* 13, 273.
soustraire 233, etc., *-ere* 262, etc., *soutraire* 437, etc.; *imperat.* 2 *sg.* *soustroi* 19 : *v.*
subtraire, *v. a.* 230.
subtration 88, *-acion* 222, 228, 270, *sf.*
sus, *prep.*; *contenir s. soi* (corr. *sous* ?) 40.

tenir, *v. a.* contain 42.
tenor, *s.* manner 226.
totedi, *adv.* 102.
traire, *v. a.* extract 506, 519; *soi t. en droit*, be correct 513.
translater, *v. a.* 1, 74.
•*trespousser*, *v. a.* push aside 206.
trive, *sm.* trivium 37, 39.
trover, *v. a.* invent 52, 80.

ultime 338, *-isme* 339, 438, 469, *adj.*
unité, *sf.* unit 126, 285, etc.

veu, *adj.* empty, vacant 495; probably a dialectal form of *vuit*, cf. *veut*, *veude*, *veudier*, quoted by Godefroy; for the fall of the *t*, cf. O. Fr. *vuier* by the side of *vuidier*.
visde, *s.* craft, cunning 30.
voier = *veoir*, *v. a.* 166.

Argorisme 79, 81; cf. L. C. Karpinski, Robert of Chester's Latin translation of the Algebra of Al-Khowarizmi, New York, 1915, p. 13.
[*Donnet*], Donatus, Latin grammar 60.
Grece 77.
Ysidre, Isidore 14, 21, 27.

(*Oxford*) E. G. R. WATERS.

The Teaching of Elementary Geometry in the Seventeenth Century.

Almost the sole source of information obtainable in this investigation is the supply of textbooks left us from that period. Unquestionably this fact renders achievement in the study more difficult. But the handicap is not as great as might at first be supposed. This is true, first, in view of the fact that there is available an abundance of texts used in the seventeenth century, and, secondly, because the large majority of these are from the pens of the most prominent and influential teachers of that period. We shall now consider these points more in detail.

THE TEXTBOOKS.

A survey of the works in a number of libraries (1) of the United States which are rich in this material discloses the fact that there are approximately two hundred different texts extant on seventeenth century geometry. The reader will find about one hundred seventy-five of these listed in the bibliography, which does not give many of the editions of EUCLID's Elements published during this century (2). Writings on the subject appeared in all of the chief vernacular languages of that day, as well as in Latin. The number of Latin works, however, is considerably less than was the case in the preceding century, and those which were printed in this language were in the main editions of productions that first appeared in the sixteenth century. Not counting the different editions of each, there are among the books examined in the preparation of this paper about a dozen works in the German language, and a like number in English; approximately two dozen each of French, Italian and Latin; and about a half dozen Dutch volumes.

(1) See the author's checklist in *Isis*, 10, 21-32 for complete titles of works briefly referred to here.

(2) HEATH : « Euclid », v. I, ch. VIII.

The writing of texts in Germany during this time was doubtless cut short because of the destructive influence exerted upon the schools by the Thirty Years War. Due to the fact that England held much longer to pure Euclidean Geometry than did any of the continental countries, we do not find so many independent English texts. Great productive activity marks this period in France and Italy. Such French works as those of LAMY (3), ARNAULD (4) and LE CLERC (5) met with general approval and were given wide recognition. The texts of some of these French writers were highly appreciated by students of other nationalities, as is proved by the number of foreign editions of their works. Italian textbooks of this century are devoted almost entirely to the applications of geometry. Thinking of the works as divided into groups according to the languages in which they appeared, the Italian group is by far the most practically inclined of the seventeenth century.

Not much is definitely known about which of the above texts were used, nor to what extent geometry was taught, in the early period of the American Colonies. There are, however, indications that those who were interested in the pursuit of mathematics found it possible to provide themselves with books. We are told that geometry was one of the courses of study offered in Harvard College in 1642 (6). We know furthermore that in 1659 some mathematical books were given to the library of Harvard College (7); that geometrical instruments were used at this early date (8); and that friends in England were desirous of supplying the colonists with works on mathematics (9). The two works of NORWOOD, «Trigonometry », 1631, and « Epitome of Navigation », 1667, were early used in the colonies. The latter work was one of the books ordered by SAMUEL SEWALL in the year 1700 (10) while the former is listed among the titles of a colonial library of the last quarter of the seventeenth century (11). Some of the NORWOOD books contain

(3) « Les Elements de Geometrie », 1685.
(4) « Nouveaux Elemens », 1667.
(5) « Pratique de la geometrie », 1669 and « Traité », 1690.
(6) T. G. WRIGHT : « Literary Culture in Early New England », Yale Univ. Press, 1920, p. 19.
(7) *Ib.*, p. 42.
(8) *Ib.*, p. 49.
(9) *Ib.*, p. 72.
(10) *Ib.*, p. 119.
(11) *Ib.*, p. 130.

preliminary material on geometry. For example, the 1685 edition of MATTHEW (son of RICHARD) NORWOOD's « System of Navigation » devotes the first chapter to a discussion of geometrical principles, in which thirteen problems of construction of the usual sort are treated. CAJORI tells us that the printed work of ALSTED (12) is known to have been used in 1726, and may have been used earlier (13). Coupling with this the statement in the diary of INCREASE MATHER for the years 1675 and 1676 to the effect that he read a book by ALSTED (title not given) (14), it becomes all the more likely that this text was used in the colonies in the period in question. There were also other books on mathematics used. In 1693, sixty-one works on mathematics and astronomy were offered for sale in Boston. Forty-eight of these were in Latin and the remainder in English (15). But, with all of this, we know that no professorship in mathematics was established in William and Mary College until 1711, and in Harvard College until 1727 (16).

THE AUTHORS.

Before a true estimate of the value of these works as textbooks can be made it is highly important to know about their authorship. We find that an overwhelming majority of the writers were outstanding teachers of their day. Among the authors referred to in the checklist published by the present writer in *Isis*, 10, 21-32, we list the following with their occupations : 1. CLAVIUS was a Jesuit of considerable ability. His contemporaries called him « the Euclid of the Sixteenth Century ». He was a successful teacher in Rome for twenty years. 2. MILLIET DE CHALLES, also a Jesuit, was « professeur royal d'hydrographie à Marseille », taught also in the « collège de la Trinité », Lyon, and later was called to teach at Turin, where he died shortly afterwards. 3. HOFMANN was the first professor of mathematics in Helmstädt and at later dates taught also in Marburg and Jena. 4. METIUS was a teacher in the University of Franeker for many years. 5. The Jesuit PARDIES

(12) First edition, 1613.
(13) « The Teaching and History of Mathematics in the United States », p. 23.
(14) WRIGHT : « Literary Culture in Early New England », p. 130.
(15) *Ib.*, p. 127.
(16) *Ib.*, p. 171. Also SIMONS : « Introduction of Algebra into American Schools n the Eighteenth Century » 1924, p. 4.

likewise was a teacher in various places with special success in Paris. 6. It is well known (17) that PETER RAMUS, one of the best pupils of FINAEUS, distinguished himself as a teacher both of philosophy and mathematics. 7. LAMY taught in three different schools and gave much thought to the general principles of teaching. The last eighty-two pages of his work, « Les Élements de Géometrie », are given to a treatment of method in study. This will be discussed later. 8. TACQUET gave fifteen years of his life to teaching. 9. WILLIAM LEYBOURN divided his time between giving instruction and acting as a professional surveyor. 10. The one Spanish work listed was written by ZARAGOÇA, a Jesuit teacher of scholastic philosophy in the earlier part of his life and of mathematics in Madrid the latter years of his career. Likewise, 11. ROHAULT, 12. BLONDEL, 13. RECORDE, 14. GAUTRUCHE, 15. ALSTED, 16. BOURDIN and many others were teachers.

Among the few who were not teachers by profession may be named : 1. STEVIN, who was at different times book-keeper, revenue officer and inspector of dykes, but who was in spare time the private instructor of Prince MAURICE OF NASSAU; 2. BEUTEL spent much of his time in secretarial work. 3. ARDÜSER, 4. ERRARD and 5. RUDD were engineers.

Thus we see that, having at our disposal the numerous works still extant, nearly all of which are the direct outcome of the class-room experiences of great teachers, a careful study of these books will convey to us not only much about the order of presentation of material, but also will give certain information as to their motivation in teaching and even reveal something of their methods of class-room instruction.

MOTIVATION — PURPOSEFUL INSTRUCTION.

In discussions given at the present time on the aims of mathematical instruction, the arbitrary classification into three groups is customary. Our first emphasis is now placed upon the utility of the subject. Besides this there are those who do not tire of pointing out the value of the teaching of mathematics from a disciplinary point of view, while others stress its cultural value (18). Something

(17) GRAVES : « Peter Ramus ».
(18) « Reorganization of Mathematics », pp. 6-12.

can be said in favor of each of these classes of aims. It is, of course, to be understood that these divisions are more or less artificial and that in reality any one is not all exclusive of the others. But for convenience we shall retain these three classes of aims in our treatment of seventeenth century geometries.

1. UTILITARIAN AIM.

Never in the history of geometry has there been a time when more emphasis was placed upon the utility of the subject than in this period. In fact almost all of the works display a strong tendency toward the practical. Even those authors who do nothing more than select for their texts material from EUCLID sometimes make it a point to show the uses of the propositions which are given. Thus we find that the work of BRUNN (19) contains only those parts of EUCLID which the author thinks are of more practical value. These are, chiefly, constructions. REEVE WILLIAMS (1685) who translated the geometry of DE CHALES entitled the book « The Elements of EUCLID, explained and demonstrated in a New and most easie method. With the uses of each proposition in all the parts of mathematicks. » For example, on page 204 of this work is found proposition XVI of Book IV : « To inscribe a Regular Penta-decagon in a Circle. » After showing how the construction is done, he gives the following « Use » : « This Proposition serveth only to open the way for other Polygons », etc. Occasionally he omits a proposition altogether, stating that it is unnecessary. The same plan is followed by the later work of WELLS who, in the preface of his work (20), says, « I have not only subjoin'd to the several Theorems relating to Lines and Planes some of their Uses, but have also illustrated the same by Examples, relating to taking Heights and Distances, or to Surveying, etc. ». On page 206 he writes, « Of any Triangle ABC, one side BC being produc'd, the extern Angle ACD, is equal to the two intern and opposite A and B. And consequently, all the three intern Angles, viz. A and B, and ACB, are together equal to two Right. » After demonstration he says, page 208, « Besides the great Use of this fourth Theorem (and its Corollaries) in demonstrating other Propositions, on it more immediately depend several Particulars of great Use in Prac-

(19) « Euclidis Elementa Practica », 1625.
(20) « The Young Gentleman's Arithmetick and Geometry », 1723.

tice, some few of which I must be content here to take Notice of ». He then proceeds to show its use in the method of taking the height of an object by the quadrant and the method of finding the sum of all the angles in any polygon.

The only reason given by LEYBOURN (21) for learning geometry is utilitarian : « The Utility and Benefit of this most excellent Art, is of such importance, that without it we can scarcely live, much less preserve ourselves from danger, or hinder the irruption of foreign Enemies; for by the Rules hereof the Geodetian may measure, plot, and give you the true Symetry, Situation, and superficial Content of your Lands; search out all manner of Highths, Depths, and Distances, whether they be accessible or inaccessible : The Military Architect may hereby fabricate his Fort. The General, or Major, embattail his Army : The Quartermaster order and set out his Quarters, and incamp his Soldiers : The Engineer plant his cannon, convey his Mine to any assigned place under the Ground, to doe execution upon his Enemy to their greatest disadvantage. » He continues, pointing out that the benefit of geometry does not end « in these terrestrial practices », but also « extendeth to the Mensuration of the Celestial Bodies ».

Everywhere in these works one is reminded of the thorough familiarity of the authors with the applications of geometry. This led them to a choice of text material that entered into the experiences of the average person. Thus PHILIPPE NAUDÉ lists in his preface the purposes he had in writing the book. He states, among other things, that earlier German works presented their material in such an unnatural way that the beginner found it exceedingly difficult to use it (22). He must have had some notion of the very thing upon which we are now so strongly insisting (23), namely, that mathematics be presented in such amount and manner as will meet the needs of the student as he is confronted by the social, scientific, industrial and political problems of every-day life.

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(21) « Cursus Mathematicus », 1690, p. 205.

(22) Ed. of 1706.« Endlich brauchen sie auch viele solche Redens-Arten/ welche von dem gemeinen Gebrauch im Reden so weit entfernet/ uns so unnatürlich scheinen/ dasz sie bei denen Anfängern/ nicht anderst als mit groszer Mühe können gebraucht werden ».

(23) « Reorganization of Mathematics », pp. 6, 7.

2. DISCIPLINARY AIM.

There was no doubt in the minds of seventeenth century writers as to the possibility, or even inevitability, of the « transfer of training » received by the mind in mathematical studies to other fields of endeavor (24), although this aim in mathematical teaching was secondary to the utilitarian view already mentioned. Many of the writers stress in their prefaces the disciplinary value of the subject. A typical example will be sufficient to give the point of view generally held. The author of « The Elements or Principles of Geometrie », writing on demonstration on the first page of his introduction, says that « nothing is so apt (as demonstration) to strengthen our Reason, to give us a clear notion of things, and secure us from being imposed upon by fallacies or shadows of proof, as conversing herein. — He must not leave it, (the demonstration) till all be as clear as if writ uith a beam of the Sun. And though some of the Theorems may not be of such universal use as others, yet all will be profitable to perfect the Mind and Reason, when they are thus clearly apprehended ».

3. CULTURAL AIM.

Nor were these writers unmindful of the cultural effects of the study of geometry. Due recognition is given to the value of the subject in cultivating in the student a higher sense and appreciation of beauty. BEUTEL brings this out most admirably in the preface of his « Lust-Garten », edition of 1729, where he points out the value of geometric proportion to the artist in his work of beautifying the world. After other arguments he finally concludes that, were we compelled to dispense with geometry, we should have to live among one another in confusion and impropriety as do the rudest Indians. (25) Even the title of his book brings out his appreciation of the esthetic value of the study. The fact that Beutel wrote also a work on « Mathematische Schönheit » attests further the attitude of cultural appreciation.

Among others, EDWARD WELLS, rector of Cotesbach in Leicestershire, sees in the study of mathematics the means of raising the

(24) *Ibid.*, p. 90.

(25) 1729 ed., pref. « In Summa, wenn wir nechtst Gottes Wort die edle Künst Geometriam nicht hätten, so würden wir eben in solcher Confusion und Ungeschicklichkeit unter einander leben, wie die rauhest Indianer. »

mind « to more clear and sublime Apprehension of his (God's) Divine Perfections » (26). « For », he writes, « we are assured (27) by the wisest of Men that GOD has order'd all Things in Measure, Number, and Weight, that is, according to the Rules of Mathematicks : And therefore, He that would rightly apprehend the Excellent Order or Contrivance of the Creation, must first understand the Sciences relating to Measure, Number, and Weight, that is, the several Parts of Mathematicks ».

Thus we see that the geometers of the seventeenth century were in surprising agreement in their aims with the statement of the National Committee on Mathematical Requirements (28) « The primary purposes of the teaching of mathematics should be to develop those powers of understanding and of analyzing relations of quantity and of space which are necessary to an insight into and control over our environment and to an appreciation of the progress of civilization in its various aspects, and to develop those habits of thought and of action which will make these powers effective in the life of the individual. »

METHOD OF PRESENTATION OF MATERIAL IN THE TEXTS.

1. SYNTHETIC AND ANALYTIC METHODS.

In all of the history of geometry one method of presenting the material of the subject in the textbooks has overwhelmingly overshadowed all others. This method is the synthetic. It is the predominant method of the seventeenth century. This is obviously true because the synthetic presentation has something to recommend it. A few points will be considered.

It is very advantageous to the geometer who would emphasize logical exposition. The logician feels himself secure when, and only when, he can proceed with sure and direct step from the known to the unknown. Because there have been in every century since the day of EUCLID those who stressed logic, the synthetic method has retained its high place in the texts.

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(26) See his pref. See also « Reorganization of Mathematics », p. 10.
(27) Here he cites Wisdom of Solomon, Chap. II, v. 20.
(28) « Reorganization of Mathematics », pp. 10, 11.

Brevity is another outstanding advantage of the synthetic method. Were it not for the fact that nearly all theorems are proved synthetically in the texts, works on geometry would of necessity be much larger and more cumbersome than they are. If the chief interest of the reader is to obtain a formal, concise, beautiful proof, he would always prefer the synthetic statement.

Students of the seventeenth century recognized — as those of other ages also have — that in mathematics is to be found more clearly presented than in any other subject of study a distinctly characteristic type of human thought which every civilization of the world has of necessity appropriated to its own needs. The mode of thought of mathematics, and of geometry in particular, leads the thinker to the drawing of conclusions which are in themselves certain, which lead to other certain conclusions, and which are found « in human intercourse in general » (29). The synthetic method of presentation more clearly than any other brings out this certain progress from conclusion to conclusion.

As one writer of the present time has put it, « for formal statements of proofs obtained, for their permanent record, for summaries, for reviews, the synthetic method is invaluable in the class-room (30).

On the other hand, there is very often an obscurity of explanation in connection with the brief and beautiful synthetic proof which leaves with the learner a sense of helplessness. The method of attack is missing. This fact has led to a rather strange state of affairs in geometry. While the textbooks have been synthetic, the analytic method of presentation has had the preference. The same author just quoted above (31) says that « there is no question that the atmosphere of the mathematical class-room should be analytic from the primary school to the University ».

This appreciation of analysis is much in evidence in the works of this study. The analytic method of attack was unquestionably widely used in teaching, although, as now, not frequently seen in texts. That the distinction between these methods was clear to seventeenth century writers is assured us by the fact that even

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(29) J. W. A. YOUNG : « The Teaching of Mathematics in the Elementary and the Secondary School », 1906, p. 19.

(30) *Ib.*, p. 56.

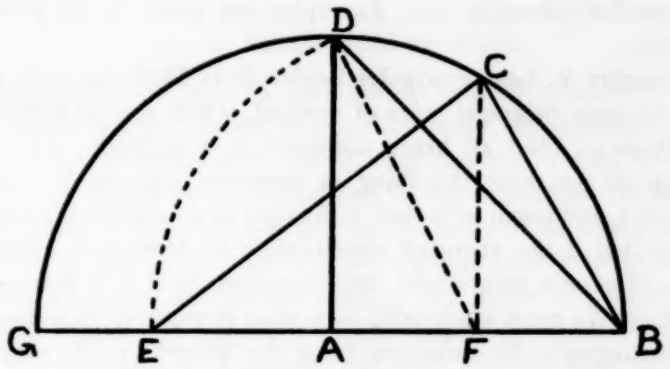
(31) *Ib.* ,p. 56.

EUCLID's Elements both defines and illustrates these terms (32). Furthermore, PAPPUS explains quite fully and clearly the two processes. The following quotation gives in part the account of PAPPUS : « Analysis then takes that which is sought as if it were admitted and passes from it through its successive consequences to something which is admitted as a result of synthesis : for in analysis we assume that which is sought as if it were (already) done (γεγονός), and we inquire what it is from which this results, and again what is the antecedent cause of the latter, and so on, until by so retracing our steps we come upon something already known or belonging to the class of first principles, and such a method we call analysis as being solution backwards (ἀνάπαλιν λύσιν) » (33).

There is among the works of this period one text that differs most widely from all the rest in that it gives a full book to the subject of method. This is the « Elemens » of LAMY (34). This work is composed of five books, the last of which has thirteen chapters, as follows : « Chapitre Premier. L'on peut déduire des Elemens qui ont été expliquez ci-dessus, tout ce qui se peut sçavoir de Geometrie, lors qu'on suit une bonne methode. » In this chapter he explains that in the preceding four books of his work he has by no means said all that might be said on the three dimensions of bodies, but that many other propositions might be deduced. He calls attention to the need of independent effort on the part of the student and the comparison of the results of such efforts with the works of great men to see wherein he lacks. He mentions ARNAULD as one author who treats some theorems more fully than he himself does. Finally he considers some problems on the section of triangles. « Chapitre II. De la methode qu'il faut suivre dans l'examen d'une question » The chief point of this chapter is that the student must practice concentration of the mind. « Chapitre III. Il faut premierment, éclaircir une question. En second lieu retrancher ce qui ne feroit que l'embarrasser, et suppléer les choses qui la rendent plus claire. On doit employer des termes propres pour l'exprimer. » That is, the question must first be clear, the confusing part eliminated, other things supplied which will render it more intelligible, and correct terms of expres-

(32) Bk. XIII, 1-5.
(33) HEATH : « Euclid », v. I, p. 138.
(34) 1685, pp. 255-336.

sion must be employed. By this he means the use of good figures, convenient notation and the like. To illustrate, he considers this exercise :



« We say that if BC is equal to the radius AB, BD is the chord of 90 degrees, and CE is taken equal to BD, then the line ED will be the side of the regular inscribed pentagon in the circle of which AB is the radius. The question is to determine whether this is true or false. » (35) After answering the question with considerable detail he adds : « Remarquez bien que ce qui nous a facilité la démonstration précédante, c'est que nous avons éclairci la question, et donné des noms convenables aux lignes proposées, ayant nommé 2a le rayon du cercle. L'éclaircissement d'une question consiste souvent à faire une figure qui l'exprime bien. » (36) It sounds very much like what a teacher would tell his class today.

« Chapitre IV. Ayant supposé la chose que l'on cherche, telle qu'elle doit être, en considerant les proprietez qui lui conveniennent l'on connoît si ce qu'on propose est possible, et le moyen de resoudre la question. » The sense of this chapter is as follows : After the figure has been drawn according to the proposed problem, one must consider the properties which follow from the supposition and the construction of the figure. It may be that the problem will be seen to be impossible of solution. If not, one must consider 1. what is known about the properties appertaining to the figure, 2. what is known about the angles involved, by which ratios

(35) *Ib.*, p. 267.
(36) *Ib.*, p. 268.

between certain lines may be established, and 3., this much having been done, one passes from « knowledge to knowledge ». Finally, 4. he calls attention to the proportionality theorems in connection with similar triangles (37). Examples are given as in previous chapters.

« Chapitre V. Les principales Regles de la Methode. » He gives eight of these principal rules of method, which are, in substance, as follows : 1. Not all being unknown in a question, we obtain enough to represent the thing in question, suppose it done as requested, and begin with that. 2. As soon as a question is proposed we can tell if the required construction is dependent upon our choice of certain magnitudes, and consequently if it is determined or not. 3. We must study with care what is required in a question and distinguish the unknown from the known. 4. We discover in a question the value of an unknown magnitude by the properties of the figure which has been made for the problem, and by the known relations between the unknown and known magnitudes. 5. Upon examining what the known relations are of which the proposed problem speaks, we devise a way of expressing them in two manners, i.e., in the form of an equation. 6. The different terms of the equation should be expressed, if possible, so as to involve only one unknown letter. 7. Having an equation or a double expression, in which there is but one unknown, we must treat it so as to get the unknown on one side of the sign of equality and the known on the other. 8. Reduce the terms of the question to the simplest form. As before, ample explanation and illustration is supplied with each rule (38).

« Chapitre VI. Les Problèmes que l'on entreprend de résoudre par l'ordre qui est ici expliqué, et que nous avons appelé ailleurs Analyse, se distinguent en certaines classes : ils sont ou lineaires, ou plans, ou solides. » After discussing these types of equations (linear, quadratic and cubic), he takes up in the remaining seven chapters, among other things, their solution, the method of some particular problems and the possibility of solving them with ruler and compass.

Through all of his work we find evidence of an unusually clear mind and an easy yet thorough method of dealing with even the

(37) *Ib.*, pp. 273, 274.
(38) *Ib.*, pp. 282-288.

more abstract subjects. According to the testimony of his works, Lamy was a man of great learning and a teacher of extraordinary power.

2. PEDAGOGICAL APPROACH.

Considering the texts of seventeenth century geometry in the light of the present, as we of necessity must, the question of the organization of material is one of deep concern. Today we want the subject matter to be challenging to the interest and ingenuity of the student, practical not only in the sense of its being usable, but also in that it fits well into the various situations of human interest, and organized in such manner that there will be a pedagogically reasonable approach to the formal geometry. We feel that the teaching of geometry has long enough been laboring under the burdens of tradition and that there is no necessity of the subject being made one of unusual difficulty but rather that it can be taught and taken not only painlessly but with pleasure.

Much of this can be made possible by properly selecting and arranging the material. That this is considered important by writers of the present is seen in the fact that in ten of the leading geometry texts of today there is an average of more than twenty-five pages of informal preliminary geometry before the formal part is taken up. Instead of offering to define precisely such terms as point, straight line, magnitude, space, plane, surface, distance, direction and solid, writers now discuss them informally. (39) There is, furthermore, no hesitation on the part of writers to put into their geometries what once would have been considered as belonging strictly to books on algebra, trigonometry or other subjects. The algebraic or any other method of analysis is used with freedom. Material is organized to harmonize with the way in which the students learn most naturally. The formal, logical presentation of all elementary mathematics must yield to the psychological.

Seventeenth century texts do not, of course, come fully up to our present ideals from a pedagogical point of view. Their authors could not take into account the findings of psychology when that science was unknown as such. But they did surprisingly well. Many of them, it should be recalled, were philosophers as well

(39) « Reorganization of Mathematics », p. 75.

as mathematicians, and philosophy is the mother of psychology. At any rate, numerous good pedagogical principles are found in the geometries of this study. Recalling, as the author has already done in an earlier article in *Isis*, that at the beginning of the century two distinct branches of geometry, theoretical and practical, were recognized, and that in the last quarter of the century a combination of the two was effected, it will readily be seen that with the exception of the present day no more opportune time was ever presented in the history of geometry for a thorough reorganization of the subject-matter.

A considerable number of the authors of the period make statements in title, preface or elsewhere, indicating clearly that a dominant aim of the century among textbook writers was the presentation of material in such manner as to make it more easily taught and learned. Thus in giving reason for the particular divisions of his work, HOFMANN writes that he did it for the sake of better teaching (40). BOURDIN stresses clarity of representation by figures in order to save the student time and difficulty : « Le cours de mathématique, abregé et clairement representé par figures, en faveur de ceux qui veulent apprendre les Mathématiques en peu de temps, et sans peine. » (41) Men were then, as they are now, seriously searching the horizon to find new and better teaching points.

3. PRELIMINARY MATERIAL.

A wide range of preliminary material is found in these works. The following topics are variously treated : 1. Introduction of Terms. 2. Acquaintance with Axioms and Postulates. 3. The Use of Geometry. 4. Use of Instruments in Construction. 5. Introduction of Symbols. 6. Acquaintance with Geometric Forms. 7. Historical Sketch. 8. A Bibliography. 9. The Relation between Geometry and Other Branches of Mathematics. These topics will now be taken up in some detail.

a. *Introduction of Terms.*

It has been stated that definitions are present in great number. But they have neither the formal character of the definitions of EUCLID's Elements nor of those in nineteenth century geometries.

(40) Ed. of 1653, p. (5), « umb besser Unterrichts wegen ».
(41) Ed. of 1661, p. 4.

Terms are discussed rather than defined in some works, while in others they are discussed and explained after having been defined. The only lack of freedom with regard to the introduction of terms is in connection with the place given them in the book. Sometimes all definitions are printed together. The works of GRUBER (42) and ERRARD (43) may be mentioned as examples. Others introduce the definitions only when needed. An excellent example of this is the already much quoted book of LAMY. He has nowhere a large number of definitions together. There is a general mixture of theorems, corollaries, postulates, lemmas, scholia, definitions, each being introduced as needed. This is a point now considered as one of pedagogical value.

b. *Axioms and Postulates.*

Mention has already been made of the number of axioms and postulates contained in these works. Writers were free to use as many as seemed convenient to them. Tradition did not bind them to the number used by Euclid, nor did they hold strictly enough to the logical point of view to want to reduce the number to a minimum. Only in recent years have we come to realize that this freedom in the use of assumptions is highly desirable from a pedagogical point of view. (44).

While the majority of works list axioms and postulates at the beginning of the book, others give them when needed. LAMY has in his work (45) about forty « suppositions » or « demandes », distributed according to the need. This also is becoming more and more the custom with writers of the present time. (46).

c. *Use of Geometry.*

Either in the preface or under a separate heading at the beginning of the book, these geometries nearly always bring out their estimate of the utility of the subject. The Latin edition of LE CLERC (47)

(42) Ed. of 1702, pp. 3-13. « Von Benennung der Dinge/ so in der Geometria fürkommen. »

(43) Ed. of 1620. Defs. precede the three books.

(44) « Reorganization of Mathematics », p. 25.

(45) Ed. of 1685.

(46) PALMER-TAYLOR-FARNUM : « Plane Geometry », 1924; also AVERY : « Plane Geometry », 1925.

(47) Ed. of 1692, p. 3. « De ejus utilitate. »

is a particular example of this. He refers to its applications in studies of astronomy, geography, architecture, machinery, optics and military tactics. This also is now agreed upon as a point of pedagogic value. (48).

d. *Use of Instruments.*

Seventeenth century geometers differ very widely from EUCLID in the use of instruments. The latter, as is well known, excluded mensuration and all practical material from his work and held strictly to the use of ruler and compass. The former made use of as many instruments that were valuable in mensuration as they as they could devise. BOURDIN (49) devotes two full pages of discussion and two more of figures to the explanation and illustration of the instruments of geometry. These were doubtless used and perhaps even constructed by the students. There is good pedagogy in the use of various devices whose operations involve the application of geometric principles.

e. *Introduction of Symbols.*

It has already been stated that it was not until near the close of the period of this study that the commoner symbols now in use met with general acceptance. This lack of a standardized symbolism made it necessary for each writer to give careful explanation of those signs and characters which he intended to use in his work. Hence there was greater need of some preliminary space being occupied with this explanation than there is today. The use of symbols became with some authors, as, for example, HERIGONE, almost a fad and, because of the excessive number used, complicated rather than aided the teaching process.

f. *Acquaintance with Geometric Forms.*

The student of seventeenth century geometry was made acquainted with geometric forms not so much through the introduction of preliminary construction work in connection with the use of instruments, as by the copious graphical illustration of the terms defined and the practical nature of the material throughout the texts. Such works as the « Nova Geometria » of LE CLERC serve

(48) The texts of AVERY and PALMER-TAYLOR-FARNUM have this preliminary material.

(49) 1661, pp. 14, 15.

almost exclusively the practical aim of making the student familiar with the geometric forms common in nature and life.

g. *Historical Sketch.*

An historical sketch is frequently included in the preliminary material just as is now done by the more modern texts. Thus « La Géométrie française » by BEAULIEU (1676) contains an « Avant-propos de l'auteur à toutes conditions sur le sujet de l'origine et commencement de la Géometrie, des premiers Hommes qui s'en sont servis, les premiers inventeurs d'icelle ». Similarly LEYBOURN (1690) and LE CLERC (1690) include short sketches of history.

h. *Bibliography.*

Very rarely one finds at the beginning a short bibliography of the writings used in the preparation of a book. An interesting one is found in the work on mechanical instruments by HULSIUS. The author lists eighty-three writers the products of whose pens have been useful to him. He begins with ARCHIMEDES (210 B.C.), not feeling very sure about earlier writers (50), and closes with his own contemporaries.

i. *Relation between Geometry and Other Branches of Mathematics.*

Occasionally some attempt is made to show how geometry is related to other branches of mathematics. Thus KECKERMANN gives at the beginning (51) a general table of the sciences showing how the subjects are related to each other. Attention has already been called in an earlier article (See the author's article in *Isis*, vol. X on The Distinctive Features of 17th Century Geometry, under Proportion and Similarity of Polygons.) to the lack of sharply drawn lines of separation between the branches of mathematics, and LEYBOURN, TACQUET, ARDÜSER and OUGHTRED were mentioned as authors whose works illustrate in one way or another some phase of correlation. BLONDEL's « Cours de Mathématique » (1699) gives fifty-six pages to a treatment of mathematics in general before

(50) Ed. of 1604, p. 6. « Wir wöllen hie nicht weitlaufftig vermelden was IOSEPHUS TERTULLIANUS, ORIGINES und andere schreiben/ dass SETH der Sohn von ADAM, HENOCH, ABRAHAM, IOSEPH, MOYSES, etc. die Mathematic. Kunst gepflegt haben/ sondern wöllen zu denen kommen /davon wir jehr sicherheit haben/ und deren Bücher gefunden werden. »

(51) 1621, p. 52.

considering speculative and practical geometry. These efforts on the part of textbook writers at giving the student a general survey of the field of mathematics before taking up geometry in particular obviously have in them that which savors of good pedagogy.

4. ORDER OF FORMAL GEOMETRY THEOREMS.

We naturally look for some regularity of the order of formal theorems in the geometries of the seventeenth century because of the fact that the texts of the present time show so much uniformity. An examination of ten geometries published during the last few years indicates the usual sequence to be about as follows : 1. Rectilinear figures. 2. Circle. 3. Proportion. Similarity of Polygons. 4. Areas of Polygons. Trigonometry. 5. Regular Polygons. Measurement of the Circle. Other topics may be introduced here and there or the subject of areas may be interchanged with proportion and similarity, which are then followed quite naturally by trigonometry. But with the exception of these changes one modern geometry is, in general outline, very similar to any other. The chief difference between the above sequence of subject-matter and that of Euclid's Elements, so far as that which is common to both is concerned, is that Euclid considered regular figures immediately after the circle.

The editions of EUCLID's Elements and those works which adhere quite closely to the Elements do, as is expected, agree quite well in sequence. But we find a wide variation in the practical texts. A few examples will serve to illustrate.

The practical geometry of ERRARD (1620) is composed of three books. 1. Seven chapters on altimetry . 2. Eleven chapters on areas, including the mensuration of the spiral and oval. 3. Fourteen chapters on the measurement of solids, in which irregular solids, spheroids, and bodies with oval and spiral bases are considered.

VAN CEULEN's work (1615) takes this sequence : Part I, 68 pages, mostly arithmetic. Part 2. 46 pages on the fundamentals of geometry with examples. He refers to propositions of Euclid. Part 3. 53 pages on the changing of figures. Part 4. 34 pages of examples in geometry.

The contents of SCHWENTER's volume (1667) is as follows : « Im I. Aus rechtem Fundament gewiesen wird; wie man in der Geometria, auf dem Papyr und Lande/ mit denen darzu gehörigen

Instrumenten ja zur noht/ ohne dieselben/ verfahren und practiciren solle. »

« Im II. Wie ohne einig künstlich Geometrisch Instrument/ allein mit der Messruthe und etlichen Stäben/ das Land zu messen. »

« Im III. Die Beschreibung dess nützlichen Geometrischen Tischleins M. JOHANNIS PRAETORII. »

« Im IV. Die Erfindung CAMILLAE RAVERTAE, aus einem Stand das Land zu Messen. »

Besides omitting most of the rigorous formal geometry the works of the type illustrated above usually contain something on altimetry and conic sections. Great value was placed on the ability to measure inaccessible heights and distances. That conic sections and the spiral were so often included is due in part, at least, to the fact that geometers did not limit themselves to the use of ruler and compass.

5. TRIGONOMETRY.

The practice of introducing trigonometry into earlier courses of mathematics was pointed out in the previous article by the author in *Isis*, already referred to. It is only necessary here to call attention to the pedagogical value of the way in which the subject was introduced. It is highly significant that GAUTRUCHE (52), LE CLERC (53), TAYLOR (1707) and others give some numerical trigonometry along with the geometry, and that their method of introducing it is in no way disconnected or unnatural. With such suggestive examples it is difficult to account for the later arrangement of the branches of mathematics in the airtight compartments that prevailed until recently. Surely we must give seventeenth century writers credit for some of the present ideas of reform in secondary mathematical education.

6. USE OF PICTURES.

Well-drawn, clearly-lettered figures, placed in such relationship with the context that no unnecessary turning of leaves must be done by the student, are now considered absolutely essential in a good textbook. Books of this kind first appeared in the seventeenth

(52) 1668, p. 63.
(53) 1690, p. 166.

century. While the better geometries of the sixteenth century contain figures as good as the poorer works of the period of our study, the average quality of their figures is far inferior. Indeed it was not until 1556 that FINAEUS abandoned the method of putting figures in the margin.

In 1658 the great educator COMENIUS published his « Orbis Sensualium Pictus » which is the « first illustrated reading book on record ». (54). It is interesting to note that the one man to whom COMENIUS was perhaps most indebted for his methods of education was J.H. ALSTED, under whom he studied and who was one of the textbook writers of this period (55). The idea of COMENIUS on the use of pictures represents the first practical application of the intuitive method. It found its way into some of the geometries before the close of the century. Both BOURDIN (1661) and LE CLERC (1692) use the right page of the open book for figures and the left page for reading matter relating to them. In the work of LE CLERC the plain geometric figures are set in a framework of elaborate drawings, which sometimes also have some bearing upon the problem.

7. CATECHETICAL BOOKS.

There are a few works of this period which belong to the catechetical books. The geometries of RUDD (1650) and BEUTEL (1660) have been referred to. One other which appeared just before the close of the century should be mentioned. The « Mathesis Juvenilis » of STURM (1699) puts a number of the problems in the form of questions. Another important feature of this work is that directions for the use of the book are given to teachers, and the work is graded so as to be of highest value to the different Gymnasium classes.

MODES OF TEACHING EMPLOYED.

We turn now to a consideration of the actual manner in which the material of geometry was presented to the pupils. Basing our judgment only upon the material and the method of presenting

(54) GRAVES : « Great Educators of Three Centuries », 1912, p. 31.
(55) *Ib.*, p. 33.

it in the texts we are still able to obtain a fair conception of the forms of class exercises then used or forecast. This is true because of the fact — already stated at the beginning of this article — that the textbooks are the works of teachers who labored in the same field of interest covered by the texts.

THE LECTURE MODE.

That the lecture mode was by far the most popular among seventeenth century teachers is well known. From the point of view of present teaching, this mode is entirely out of place. But it was much more satisfactory then on account of the ages of the pupils taking the subject.

It has been stated that geometry students of the period of our study were in the main adults. The Gymnasia of Germany, which were among the earliest of all secondary schools to include geometry in their curricula, did not teach that subject generally until well into the eighteenth century. There were a number of exceptions, as is shown by the following quotation : « Die erhaltenen Lektionspläne des Gymnasiums zeigen 1619 und 1624 je 1 Stunde Mathematik in I, dagegen 1643 in allen 3 Klasses combiniert eine Stunde Arithmetik und in I und II combiniert 1 Stunde ars sphaerica, ähnlich 1647. Die Geometrie ist also besonders nicht genannt, wird aber unter Mathematik mitverstanden sein, welcher Ausdruck 1643 wieder fehlt. Es darf das daraus geschlossen werden, dass die Lehrbücher, die Schröter für seinen Unterricht geschrieben hat, auch etwas von der Geometrie enthalten. » (56). A few other schools introduced mathematics during the century (57) but as a very general thing geometry was studied only by adults. When we remind ourselves that the lecture mode with occasional modifications is still very widely used at the present time in colleges and universities, with the supply of textbooks easily available to all students, it should not surprise us to find that the lecture mode prevailed in the seventeenth century when the pupils' difficulty in procuring texts almost necessitated its use.

An interesting work on this point is that of UNVERZAGT (1641)

(56) HELLMAN : « Ueber die Anfänge des mathematischen Unterrichts an den Erfurter evangelischen Schulen im 16. und 17. Jahrhundert und bis etwa 1774 », Part II, p. 5.

(57) STAMPER, pp. 64, 65.

which contains a complete program of lectures given by the author in the University of Louvain. The « ordo disputationum » is arranged by months, beginning with October and running throughout the year. Each month a new subject is taken up. Beginning with « Geometricae », the topics continue in the following order : « Arithmeticae », « Opticae », « Staticae », « Hydrostaticae », « Navticae », « Architectonicae », « Polemicae », « De Machinis Bellicis », « Geographicae », « Astronomicae », and « Chronologicae ». The work on geometry is divided into three seven-day periods. The « argumentum » for each of these three periods is here given :

Hebdomas Prima. Argumentum.

Anni secularis mensem consecramus primum GEOMETRIÆ; quòd huius elementa (de eius dignitate nihil ut dicam ad ceteras disciplinas mathematicas, aditum aperiant : quae ne, ut solent principia, difficultate incipientes terreant, facilioribus demonstrationibus, e nouo ordine illustramus. Damus itaque 1. sese secantes lineas deinde parallelas 2. Trianguli singularis, tum ad aliud relati affectiones prosequimur. 3. Circuli centrum, sectiones, contactusque, quae tum à lineis rectis, tum à circulis fiunt, consideramus. 4. Proportionem, quae inter triangula, parallelogramma, aliasque figuras similes intercedit. 5. Linearum, laterumque, quae triangula faciunt, potestatem explicamus. 6. Superficies, quae parallela, quae perpendicularis, examinamus. 7. Statuimus, quae corpora sint aequalia, qua proportione ad se mutuò parallelepipeda, prismata, cylindri, coni, sphaerae, e his similia.

Hebdomas Secunda. Argumentum.

- - - Ordiar 1. ab anguli definitione, à cuius recta intelligentia cetera omnia dependent. 2. Diversitatem proponam, quam anguli, vel à lineis vel contactu, vel superficie sumunt. 3. Difficultatem, quae hisce inest, attingam. 4. Paradoxa, quae ex angulo misto multi deducunt, 5. Opiniones, quibus de anguli quantitate auctores inter se dissident. 6. Huius anguli naturam explicabo. 7. Litem componam, dicamque : angulum mixtum indeterminatum, indeterminato angulo rectilineo, et determinatum determinato exhiberi posse aequalem.

Hebdomas Tertia. Argumentum.

- - - Quare ita hanc suppellectilem partiemur, ut explicemus 1. Cuius sint generis, quae Geometriae usum praestent. 2. Quibus radius propositam figuram omni in proportione pingendo imitetur 3. Quibus proportionibus instruat regulas, ut lineas, superficies, corpora augeat, minuat, aut permutet. 4. Remota, et inaccessa, quomodo angulis suis attingat, et quadrato mensuret. 5. Circuli partes proponimus, quae ex tabularum

subsidio accuratiùs de angulorum mensura indicant. 6. Tantò certius indicium hoc ut euadat, plures in partes singulos gradus subdiuidimus. 7. Exponimus instrumenta, quibus corporum exploramus molem.

This book is adorned at the beginning of the treatment of each seven-day period with an illustration which usually shows two children doing something relative to the work under discussion, one of them acting as teacher and the other as pupil. Both are provided with instruments and the pupil seems to be trying out the information he is getting from the teacher. This suggests strongly that the lecture mode as used by UNVERZAGT was in no way as formal as our present understanding of that manner of teaching suggests.

THE LABORATORY MODE.

We have seen that seventeenth century geometry students made unlimited use of numerous measuring devices, whole books being left us on mechanical instruments (58); that some of the textbooks of geometry were well supplied with elaborate drawings; that the chief emphasis in the statement of the aims of geometry was placed upon utility; that the subject was studied in close connection with planimetry, stereometry and all kinds of field work; and that treatises on geometry were often bound up with works on surveying, geodesy, cosmography and other studies. Furthermore, as is seen in some of the proofs, the course of progress was nearly always from the particular to the general, from the concrete to the abstract. These facts indicate quite clearly that the essential features of the laboratory mode of teaching were present to a marked degree in seventeenth century geometry.

PRIVATE INSTRUCTION.

The individual mode of teaching was one of great importance in this period, and hence we find among the textbooks some which were written for the purpose of meeting the need of private instruction. Thus the title page of the « Cours de Mathématique » of BLONDEL (1699) indicates that the book was written for the use of the Dauphin whose private teacher BLONDEL was for some time. SIMON STEVIN also gave private instruction in his spare time.

(58) HULSIUS : « Tractat der Mechanischen Instrumenten », 1604.

There are two 1684 editions of the anonymous « Elements or Principles of Geometry », one of which, according to the title page , was « prepared for use by young RALPH FREMAN », while the other was « now with due respect publicly dedicated ».

That there was much individual instruction in geometry carried on as late as the close of the seventeenth century is indicated by the following advertisement which appeared in the Boston News-Letter of March 21, 1709 : « Opposite to the Mitre Tavern in Fifth-street next to Scarlet's Wharff, Boston, are Taught, Writing, Arithmetick in all its parts; And also Geometry, Trigonometry, Plain and Sphaerical Surveying, Dialling, Gauging, Navigation, Astronomy; The Projection of the Sphaere, and the use of Mathematical Instruments : By OWEN HARRIS. Who Teaches at as easie Rates, and as speedy as may be. » (59).

THE HEURISTIC MODE.

The few catechetical works left from this period do not indicate by the nature of their questions and answers that any use was made of what we now term the heuristic mode of teaching. But if the essential feature of that mode is regarded as that procedure in teaching which will lead the pupil to discover things for himself, regardless of whether this is accomplished by questioning or otherwise, then it is clear that there is a true connection between this and the laboratory mode. Both were to some extent anticipated in this century.

OTHER MODES.

Other modes now in use, including the well-known recitation method of teaching, are not indicated in the textbooks of seventeenth century geometry now extant.

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SUMMARY.

The findings of the present investigation may now be summarized. It will be seen that numerous good pedagogical principles were used by the writers of the geometries of this period.

(59) Quoted also in SIMONS : « Introduction of Algebra into American Schools in the 18th Century », Washington, 1924.

1. While it is true that the textbooks left us from the seventeenth century furnish our sole source of information, this is not such a great handicap because
   a. about two hundred of them are still extant, and
   b. a large majority of the authors of these textbooks were leading teachers of that day.

2. We can clearly distinguish three classes of aims in the instruction of geometry in this period, as follows :
   a. Utilitarian aims received the most emphasis.
   b. A considerable number of teachers believed in the transfer of disciplinary training from geometry to other activities of life.
   c. The study of geometry was considered valuable from a cultural and spiritual point of view.

3. The synthetic method of presentation prevailed in the texts because of its brevity and value in stating formally the proofs obtained.

4. The analytic method was well known and widely used, and is especially well treated in the last book of the work of LAMY.

5. In some works terms are defined and introduced only when and as needed.

6. Entire freedom is used in some of the books in the use of assumptions. There is no effort made at cutting the number of axioms and postulates down to the minimum.

7. The use of geometry is usually given a short treatment at the beginning of the book.

8. Students were made thoroughly acquainted with the value of instruments in geometry.

9. The texts are written so as to acquaint the reader with the many geometric forms common in nature and life.

10. A sketch of the history of the subject is often given.

11. A short bibliography is sometimes found at the beginning of the text.

12. Introductory chapters are given here and there to show the relation between geometry and other branches of mathematics.

13. The lack of a standard symbolism was a handicap in teaching during this period.

14. The sequence of theorems in the works not adhering to EUCLID's Elements is quite unsettled, but some writers, in making

choice of sequence, gave careful attention to the establishment and use of better principles of teaching.

15. Numerical trigonometry was introduced in connection with the geometry.

16. Proper drawing and placing of figures added to the teachableness of some of the texts.

17. A few of the works have their material presented in the form of questions and answers.

18. The lecture mode was the most popular among seventeenth century teachers. On account of the mature ages of pupils and the scarcity of textbooks it was more justifiable then than it is at the present time.

19. The essential features of the laboratory mode are brought out in these works to a marked degree.

20. Private instruction was extensively carried on and some of the texts were written with that end in view.

21. Heuristic teaching is suggested only in connection with its relation to the laboratory mode.

22. The recitation mode, as well as other modes now considered in the pedagogy of mathematics, does not appear in the works of this study.

University of Florida. F. W. KOKOMOOR.

Le premier conflit entre la théorie ondulatoire et la théorie corpusculaire de la lumière.

Quoi de plus passionnant, dans l'histoire de la Science, que cette lutte où s'affrontent, dès leur naissance, les deux conceptions, continue et discontinue, de la nature de la lumière ? La théorie corpusculaire triomphe d'abord, assez obscurément d'ailleurs, au XVIII[e] siècle ; sa rivale prend au siècle suivant une revanche éclatante. A l'heure actuelle, le conflit est entré dans une phase aiguë, qui en fait la question centrale de toute la physique moderne : peut-être est-ce à la fin de la lutte que nous assistons, peut-être la nouvelle Mécanique ondulatoire apportera-t-elle la paix en établissant une grandiose synthèse des deux points de vue antagonistes. Quel contraste entre la formidable crise actuelle et la première escarmouche où les inventeurs des deux théories s'efforçaient de mettre en relief leurs avantages respectifs! Mais pour être plus modeste, ce premier conflit n'en est pas moins intéressant, surtout par la personnalité des deux adversaires, et il vaut la peine qu'on s'y arrête un peu, pour étudier successivement les deux thèses en présence, leurs arguments respectifs, et les causes de la victoire des idées corpusculaires.

I. — *La théorie des ondulations.*

Le créateur de la théorie des ondes est sans contredit HUYGENS ; car, comme le remarque très justement WHITEHEAD, (1) « it is the establishment of the procedure of taking the consequences seriously which marks the real discovery of a theory. » Les précurseurs (2) de HUYGENS sont en effet absolument insignifiants ; il

(1) WHITEHEAD, *The Concept of Nature*, Cambridge, 1920, p. 26.

(2) PARDIES, *Statique*, Paris, 1674, Préface.
ANGO, *L'Optique divisée en 3 livres*, Paris, 1682.
HOOKE, *Micrographia*, London, 1665.

ne se fait d'ailleurs pas faute de l'écrire lui-même, dans une lettre à LEIBNIZ, (3) à propos d'un certain KNORRE, qui avait soutenu une thèse sur la théorie ondulatoire : « Je suis bien aise de voir ma Theorie approuvée quoyqu'il me fasse un peu tort de dire que mon explication de la refraction est dans le fond la mesme que celle de HOOCKE et de PARDIES, et n'en differe qu'en la manière d'expliquer. Car tout consiste dans cette maniere, et ces autheurs auroient esté bien empeschez à rendre raison des bizarreries du cristal d'Islande, outre que HOOKE a fait des bevues honteuses que j'aurois bien pu relever si j'eusse voulu. » Il est encore plus mordant à l'égard du P. ANGO : « il dit avoir pris une partie des écrits laissés par le P. PARDIES, mais il aurait mieux fait d'éditer tel quel le manuscrit du P. PARDIES. » (« welcke seght uyt de overblijfsels van P. PARDIES een gedeelte genomen te hebben, doch soude beter gedaen hebben van het schrift van P. PARDIES uyt te geven soo het lagh. ») (4)

Il importe d'abord d'examiner dans quel esprit HUYGENS présentait sa théorie, ou plus généralement quelle idée il se faisait du rôle et de la signification des théories scientifiques. L'illustre Hollandais a subi fortement l'influence de DESCARTES : il a eu comme maître VAN SCHOOTEN, un des plus brillants disciples du philosophe français. Sans doute un esprit de cette trempe ne pouvait tarder à reconnaître les faiblesses de la doctrine cartésienne et à s'en affranchir : « ... dico ipsum [CARTESIUM] errasse in [multis rebus]... Equidem neque hanc [Cartesianam philosophiam] neque Aristotelicam neque ab uno quopiam autore denominatam invehi vellem, sed unius veri ratione haberi, ita ut a singulis ea sumantur quae optima ac rationi convenientissima censebuntur. Nihil autem magis obesse videtur philosophicis studijs quam si in formam systematis redigantur, unde rerum omnium causae quasi jam compertæ depromantur. Vix enim ullas satis adhuc tenemus, neque proficere inquirendo possumus si, quod nescimus, scire nos arbitremur. » (5) Néanmoins, malgré cet électisme et cette remarquable liberté d'esprit, il a toujours suivi fidèlement, et même aveuglément, DESCARTES sur un point essentiel

(3) *Œuvres de* C. HUYGENS, publiées par la Société hollandaise des sciences t. X, 1609 (29 mai 1694). (Ce recueil sera désigné par O. H.)

(4) O. H., t. X, p. 204 (22 novembre 1691).

(5) O. H., t. X, p. 104 (lettre à MEIER, juin 1691).

de sa doctrine, le *mécanicisme* : « Multum CARTESIO debemus quod novas vias in physicae studio aperuit atque omnia ad mechanicas rationes reducenda author fuerit. » (6) Dans le *Traité de la lumière*, il parle de « la vraie philosophie, dans laquelle on conçoit la cause de tous les effets naturels par des raisons de mécanique. Ce qu'il faut faire à mon avis, ou bien renoncer à toute espérance de ne jamais rien comprendre dans la physique. » C'est ce dogme mécaniciste qui le conduit à rejeter le principe de la Gravitation universelle, tout en admettant la loi d'attraction pour les planètes.(7) Aussi ne nous étonnerons-nous pas de le voir se donner beaucoup de mal pour imaginer un modèle mécanique rendant compte de la propagation des ondes lumineuses.

Quant à sa conception des théories scientifiques, on peut en juger surtout par la préface du *Traité de la lumière*. Il y développe l'idée qu'une bonne hypothèse est celle dont les conséquences, et surtout les prévisions de phénomènes encore inconnus, se vérifient par l'expérience; mais il ne dit rien sur la méthode qui doit guider dans l'élaboration des hypothèses. Il est un peu plus explicite dans une lettre à TSCHIRNHAUS : (8) « In quibus [physicis] ego tamen summam difficultatem restare existimo, nec aliter eam superari posse quam ab experimentis incipiendo... deinde hypotheses quasdam comminiscendo ad quas experimenta expendantur... Sed ita quoque permagnus labor superest, nec solum sagacitate insigni opus, sed saepe et felicitate aliqua. » Nous sommes loin, on le voit, de la méthode d'induction si énergiquement affirmée et si génialement appliquée par NEWTON à la découverte de la dispersion de la lumière et de la gravitation universelle. D'ailleurs, dans l'une et l'autre de ces questions, HUYGENS a pris position contre NEWTON en termes qui laissent clairement voir qu'il n'a pas compris le point de vue de celui-ci. (9)

Ce que nous venons de dire de l'attitude scientifique d'HUYGENS nous permet de comprendre le mode d'exposition de sa théorie, si différent des *Questions* qui terminent l'*Optique* de NEWTON.

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(6) O. H., t. X, p. 195 (lettre à MEIER, 16 novembre 1691).

(7) *Dissertatio de Causa gravitatis*, Additamentum, in *Opera reliqua*, Amsterdam, 1728, vol. 1, p. 121.

(8) O. H., t. IX, p. 124 (10 mars 1687).

(9) Cf. mon article sur *la théorie des Couleurs de Newton et ses adversaires*, *Isis*, 9, 44-65, 1927.

Il débute (10) par une discussion d'allure cartésienne établissant que la lumière résulte « du mouvement de certaine matière. » Il rejette rapidement, comme nous le verrons plus loin, l'idée d'une émission de corpuscules par le corps lumineux, et il introduit l'hypothèse d'une propagation ondulatoire, en se guidant sur l'analogie des ondes sonores. Ceci impliquant une vitesse finie de propagation, il s'arrête d'abord à discuter cette question. Puis il estime que la propagation de la lumière ne peut se faire par ondes de compression et d'expansion comme celle du son, à cause de sa grande vitesse. Ceci l'amène à un modèle d'ondes élastiques *longitudinales* : il imagine que l'éther est constitué par de petites particules très dures et très élastiques serrées les unes à côté des autres. Les résultats qu'il a obtenus sur le choc des corps élastiques lui permettent d'expliquer la propagation d'une et même de plusieurs ondes dans un tel milieu; il rendait déjà compte ainsi d'un fait banal d'expérience, l'indépendance des faisceaux lumineux; ce fait lui paraissait incompatible avec une théorie de l'émission. Mais le point capital et vraiment important de sa théorie est l'énoncé du principe bien connu qui porte aujourd'hui son nom, et qui lui permet d'expliquer la propagation rectiligne de la lumière. A vrai dire, il présente son principe d'une manière plutôt confuse, et il ne cherche pas à le justifier autrement qu'en invoquant la vérité de ses conséquences; néanmoins, il est certain qu'il en avait pleinement reconnu la signification et la portée : cela se voit déjà à l'usage habile qu'il en fait dans son *Traité*, et cela se verra mieux encore dans la discussion avec NEWTON. Tels sont les principes de la théorie d'HUYGENS; dans les chapitres suivants, il en déduit les lois de la réflexion, de la réfraction et la théorie de la réfraction atmosphérique; enfin l'introduction d'ondes sphéroïdales à côté des ondes sphériques lui donne la théorie complète de la double réfraction du spath d'Islande. En revanche, il doit avouer son impuissance à expliquer les phénomènes de polarisation qu'il a lui-même découverts.

L'élégance du traitement géométrique de la théorie fait du *Traité de la lumière* un véritable bijou mathématique. Aussi fut-il accueilli partout avec admiration. « On ne peut rien voir de plus

(10) J'utilise la réimpression de la Collection SOLOVINE, Paris, GAUTHIER-VILLARS, 1920 (*Isis*, 4, 148) *Le Traité de la Lumière* a été écrit en 1678, mais publié, à Leyde, en 1690 seulement.

beau que le premier de ces Traités [celui *de la lumière*; l'autre est celui *sur la cause de la pesanteur*] » écrit FATIO DE DUILLER (11). Quand j'ai vû que la supposition des ondes sphéroidales, dit LEIBNIZ (12), vous sert avec la même facilité à resoudre les phenomenes de la refraction disdiaclastique du cristal d'Islande, j'ay passé de l'estime à l'admiration » DENYS PAPIN (13) » approuve » le principe de l'onde enveloppe, et admire lui aussi l'ingéniosité de l'hypothèse des ondes sphéroïdales; il soulève d'ailleurs quelques difficultés « cartésiennes » sur la constitution de l'éther. Enfin NEWTON, par l'intermédiaire de FATIO DE DUILLER, (14) reconnaît, tout en rejetant ses conclusions, la beauté du travail d'HUYGENS : « Mais quoique cette Theorie soit parfaitement belle et digne de son Auteur, il y a des raisons tres fortes, tirees des proprietés de la Lumière et des Couleurs, qui nous persuadent que les raions de Lumière sont des corpuscules qui viennent actuellement du Soleil et des Etoiles jusques à nous. » La théorie d'HUYGENS trouva même tout de suite un écho dans les Universités : KNORRE en fait l'objet d'une thèse à Wittenberg (15), et DE LA HIRE (16) en parle dans ses leçons du Collège de France. Mais cette faveur devait être éphémère.

II. — *La théorie corpusculaire.*

Avec sa défiance bien connue à l'égard des hypothèses, NEWTON n'a jamais défendu systématiquement une théorie corpusculaire; il s'est borné à montrer que les phénomènes connus pouvaient s'expliquer par une théorie de ce genre, tandis qu'une théorie *purement* ondulatoire se heurte à des difficultés qu'il juge avec raison insurmontables. Il ne faut pas s'attendre à trouver, dans les images théoriques qu'il propose prudemment sous forme de questions, la cohérence et l'harmonie de l'exposé d'HUYGENS : le physicien hollandais se laisse guider sur une route rigide par des raisonnements *a priori*; le maître de la méthode inductive

(11) O. H., t. IX, p. 381 (24 février 1690).
(12) O. H., t. IX, p. 521 (octobre 1690).
(13) O. H., t. IX, p. 559 (6 décembre 1690).
(14) O. H., t. X, p. 605 (9 avril 1694; lettre à DE BEYRIE, communiquée à LEIBNIZ).
(15) KNORRE, *Dissertatio dioptrica de refractione luminis*, Wittenbergae, 1693. Cf. O. H., t. X, p. 600; p. 611.
(16) O. H., t. X, p. 5 (17 janvier 1691).

part de divers groupes de faits d'expériences et ne s'en éloigne jamais beaucoup; dans chaque cas, il examine soigneusement les différentes explications possibles; il les combine autant que possible de manière à aboutir à un ensemble satisfaisant : de là une théorie un peu disparate, un peu compliquée, mais aussi plus nuancée et plus souple.

C'est ainsi que dans sa théorie de la lumière, le concept d'onde joue un rôle extrêmement important; c'est un des caractères les plus remarquables de cette doctrine, et je pense qu'on ne lui a pas accordé toute l'attention qu'il mérite. La magistrale analyse du phénomène des anneaux colorés l'amène à reconnaître le caractère de *périodicité* de la lumière, au moins à l'intérieur des milieux réfringents; c'est ce qu'exprime la Proposition XII du Livre II, 3e Partie, de l'*Optique* : (17) « Tout Rayon de Lumiere acquiert, en passant à travers une Surface refringente quelconque, une certaine constitution ou disposition transitoire qui dans le progrès du Rayon revient à intervalles égaux, & fait que le Rayon, à chaque retour de cette disposition, est transmis aisément à travers la Surface refringente qui vient immédiatement après, & qu'à chaque intermission de cet état, il est aisément reflechi par cette même Surface. » Après avoir montré comment cette loi se déduit de ses observations, il ajoute : « De savoir ce que c'est que cette action ou disposition ;... c'est ce que je n'examine point ici. Ceux qui n'aiment point à admettre aucune nouvelle découverte, à moins qu'ils ne puissent l'expliquer par une hypothese, peuvent supposer pour le présent, que comme les Pierres jettées dans l'eau, y excitent des ondulations,... » les rayons tombant sur le milieu réfringent y produisent des vibrations qui se propagent à la manière des ondes sonores; « qu'elles ont un mouvement plus rapide que celui des Rayons, de sorte qu'elles les atteignent; ...& qu'ainsi chaque Rayon est successivement disposé à être aisément reflechi, ou aisément transmis par chaque vibration qui l'atteint. Mais je n'examine point en cet endroit, si cette hypothese est vraye ou fausse. »

Ainsi NEWTON avait clairement reconnu que la périodicité manifestée par les phénomènes d'interférence impliquait l'intervention d'un mécanisme « de circulation ou de vibration dans le Rayon, ou dans le Milieu.»(17) Convaincu par l'examen d'autres faits

(17) Traduction française de COSTES, 2e éd., Paris, 1722, pp. 327 sqq.

que l'ondulation ne peut être une qualité du *rayon*, il imagine une hypothèse ingénieuse expliquant comment le milieu peut communiquer au mouvement du corpuscule la périodicité voulue. D'après cette hypothèse, c'est d'ailleurs le corpuscule lui-même qui détermine, en même temps que le milieu, la longueur des ondes acolytes. Si donc on pouvait se passer du corpuscule, et adopter un modèle purement ondulatoire, on devrait imaginer chaque rayon comme une onde de longueur bien déterminée pour un même milieu, mais variant quand on passe d'un milieu dans un autre; on serait alors immédiatement conduit à établir, pour un milieu déterminé, une relation entre la ***longueur d'onde*** et la ***couleur***. Nous avons la preuve que NEWTON a poussé jusque là ses réflexions sur la théorie ondulatoire; (18) il était sur ce point infiniment plus loin qu'HUYGENS lui-même, qui avait bien vu le problème, mais qui n'avait pu le résoudre : « Les Experiences qu'a fait Mr. NEWTON de la differente refraction des raions colorez sont belles et curieuses, mais il n'explique pas ce que c'est que la couleur dans ces raions, et c'est en quoy je ne me suis pas pleinement satisfait non plus jusqu'à present. » (19)

En présence de ces faits, il me semble légitime de conclure que si NEWTON a préféré une théorie compliquée de l'émission, impliquant une dissymétrie des corpuscules lumineux (pour expliquer la polarisation) et la production d'ondes acolytes dans les milieux réfringents, c'est qu'il voyait dans la théorie des ondes des difficultés insurmontables; et il est absolument improbable qu'il se soit laissé aveugler par des idées préconçues, comme se le demande FRESNEL, (20) à propos de ses mauvaises observations sur la diffraction; nous aurons l'occasion de revenir sur ce point un peu plus loin.

III. — *La controverse entre* HUYGENS *et* NEWTON.

Dans la controverse qui va nous occuper maintenant, c'est NEWTON qui dirige le débat. Que pouvaient, en effet, lui opposer ses adversaires ? « Quand on considère, écrit HUYGENS, (21)

(18) Cf. mon article cité ci-dessus (9), pp. 61-62.

(19) O. H., t. X, p. 609 (29 mai 1694; lettre à LEIBNIZ).

(20) *De la lumière*, 1822; réimpression « Les Classiques de la Science », Paris, A. COLIN, 1914, p. 5.

(21) *Traité de la lumière*, p. 4.

l'extrême vitesse dont la lumière s'étend de toutes parts et que, quand il en vient de différents endroits, même de tout opposés, elles se traversent l'une l'autre sans s'empêcher; on comprend bien que, quand nous voyons un objet lumineux, ce ne saurait être par le transport d'une matière, qui depuis cet objet s'en vient jusqu'à nous ainsi qu'une balle ou une flèche traverse l'air : car assurément cela répugne trop à ces deux qualités de la lumière et surtout à la dernière. » Ces considérations pouvaient avoir un certain poids pour les physiciens du Continent, encore plus ou moins soumis à l'influence de DESCARTES; pour NEWTON, elles n'en avaient aucun, et il ne se soucia jamais de s'expliquer là-dessus, et de coordonner ses idées en un système minutieusement et rigidement déterminé, comme l'avait tenté HUYGENS; à son avis, tant que toute indication de l'expérience ferait défaut dans ce domaine, le physicien n'avait pas à s'y aventurer : « Hypotheses non fingo. »

En revanche, les objections de NEWTON à la théorie des ondulations étaient parfaitement précises et pertinentes. Dès 1672, (22) il fait observer que la théorie des ondes est incompatible avec la propagation rectiligne de la lumière ; il développe cette objection dans les *Principia* et dans l'*Optique*. Lorsque les expériences d'HUYGENS sur la polarisation de la lumière lui furent connues, il y vit aussitôt une nouvelle difficulté pour la conception ondulatoire, tandis qu'il imaginait aisément le principe de leur explication en attribuant des « côtés » ou des « pôles » aux corpuscules lumineux. Jusqu'au moment où FRESNEL, encouragé par ses succès dans la théorie de la diffraction, eut la géniale hardiesse d'introduire l'hypothèse des vibrations *transversales* de l'éther, les phénomènes de polarisation devaient forcément rester une objection fatale à la théorie des ondes.

La première objection, au contraire, était beaucoup plus discutable, et c'est elle qui fut discutée victorieusement par HUYGENS. C'est dans les *Principia* que NEWTON l'expose pour la première fois en détail; il démontre (Livre II, Proposition XLII) que « Motus omnis per fluidum propagatus divergit a recto tramite in spatia immota », et le Scholie qui suit la Proposition L indique qu'il avait en vue dans cette étude « motum Lucis et Sonorum » :

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(22) *loc. cit.* (18).

« Lux enim cum propagetur secundum lineas rectas, in actione sola... consistere nequit ». Mais par son principe de l'onde enveloppe, HUYGENS avait rencontré cette objection; c'est ce qu'il fait remarquer dans le Supplément au *Traité sur la cause de la pesanteur*, (23) supplément consacré surtout à l'examen de l'ouvrage de NEWTON : il ne nie pas, dit-il, l'existence des ondes diffractées, mais il pense que leur intensité est trop faible pour qu'elles soient sensibles. NEWTON donne à son tour son avis, par l'intermédiaire de FATIO DE DUILLER, (24) sur les deux Traités d'HUYGENS; au sujet du passage qui nous intéresse, DUILLER écrit : « Mr. NEWTON se rend à ce raisonnement de Mr. HUGENS. » Ceci se passait en 1694, peu de temps avant la mort du physicien hollandais. Plus tard cependant, NEWTON retourne à son opinion précédente, car non seulement il ne modifie pas le Scholie en question dans les éditions suivantes des *Principia*, mais il reprend le même raisonnement dans la Question XXVIII de son *Optique*. Peut-être sont-ce les phénomènes de diffraction qui l'ont fait douter après coup de la valeur du principe d'HUYGENS; en tout cas il croit que ces phénomènes contredisent la théorie des ondes : « A la vérité, les Rayons qui passent fort près des extrémités de quelque corps que ce soit, sont un peu pliés par l'action de ce Corps... mais cette Inflexion ne se fait pas vers l'Ombre, elle ne se fait que du côté qui est opposé à l'Ombre... » Ceci, remarque FRESNEL, (25) est une grossière erreur, d'autant plus inconcevable que GRIMALDI avait déjà observé correctement le phénomène. On ne peut toutefois, comme je l'ai dit, soupçonner NEWTON d'idées théoriques préconçues; en fait, les hésitations et les erreurs du grand physicien dans le domaine de la diffraction sont faciles à comprendre : c'est un terrain dont il a dû laisser l'exploration inachevée, après une reconnaissance fragmentaire; on sent de suite qu'il n'y est pas maître.

Une troisième objection à la théorie des ondes, bien faite pour étonner le lecteur moderne, est soulevée par NEWTON dans la même Question XXVIII de l'*Optique*: « Il n'est pas moins difficile d'expliquer par le moyen de ces Hypotheses, comment les Rayons peuvent être alternativement dans *les accès de facile Reflexion*,

(23) *loc. cit.* (7), p. 125.
(24) *loc. cit.* (14).
(25) *loc. cit.* (20).

& *de facile Transmission*, si ce n'est peut-être qu'on veuille imaginer que dans tout l'Espace il y a deux Milieux étherés qui ont leurs vibrations particulieres; que les vibrations de l'un de ces Milieux constituent la Lumiere; & que les vibrations de l'autre, étant plus rapides, toutes les fois qu'elles atteignent les vibrations du premier, les mettent dans ces accès. Mais le moyen de concevoir que deux *Ethers*... puissent être répandus dans tout l'Espace, sans... brouiller leurs mouvements réciproques ? » On le voit : NEWTON se laisse fourvoyer par une « traduction » trop littérale de sa théorie des ondes acolytes, et le concept d'interférence ne lui est pas assez familier pour lui permettre d'apercevoir la vraie solution.

En résumé, contre la théorie des ondes se dresse une difficulté insurmontable : l'explication de la polarisation. La position de la théorie corpusculaire est donc à ce moment réellement très forte. Cependant nous voyons déjà apparaître les défauts de sa cuirasse : interférence et diffraction, tels sont les deux points faibles de NEWTON; c'est précisément sur ce terrain qu'un siècle plus tard la nouvelle théorie ondulatoire remporte ses premières victoires. Mais pourquoi fallut-il attendre un siècle les travaux de YOUNG et de FRESNEL ? c'est ce qu'il nous reste à examiner.

IV. — *Les causes de l'abandon de la théorie ondulatoire pendant le XVIII^e siècle.*

Indépendamment des arguments qui la défendaient, et dont nous avons apprécié la valeur, on peut dire que la théorie corpusculaire fut surtout protégée, en quelque sorte, par l'autorité formidable dont NEWTON jouit durant tout le XVIII^e siècle. Directement ou indirectement, c'est à sa personnalité presque légendaire — « Nec fas est propius Mortali attingere Divos » — qu'il faut remonter pour comprendre l'attitude des physiciens de cette époque.

Tout d'abord, on s'accoutume dangereusement à considérer tous les ouvrages de NEWTON comme des modèles d'une perfection achevée, qui ne laissent absolument plus rien à désirer. Sans s'apercevoir que cette attitude est directement opposée aux recommandations du grand maître, on se fait presque scrupule de toucher aux sujets dont il s'est occupé : ce serait de la présomption, et en

tout cas du temps perdu ! Dans le domaine de l'Optique, c'est à peine si on ajoute aux résultats de NEWTON la découverte de la spécificité du pouvoir dispersif; malgré l'invitation expresse qui se trouve à la fin de l'*Optique*, on n'étudie pas les phénomènes de diffraction.

On interprète d'ailleurs d'une manière outrancière le fameux « Hypotheses non fingo ». (26) On en arrive à se désintéresser complètement des discussions théoriques; l'importance de nouvelles connaissances sur les points imparfaitement fixés d'une théorie n'est pas comprise. On cherche des lois, on analyse des phénomènes, on ne cherche pas de synthèse — ou plutôt on se contente d'idées synthétiques vagues et générales. Et comment ne pas s'expliquer cette fièvre de découvertes : NEWTON est là qui leur montre le « grand Océan de la vérité, qui s'étend inexploré » devant eux; lui-même a pu en extraire les joyaux les plus précieux; mais que de trésors y gisent encore, enfouis depuis trop de siècles ! Et tumultueusement, comme pour rattraper le temps perdu, on expérimente, n'importe comment, sur n'importe quoi; et c'est un émerveillement de tous les instants ! Pourquoi s'attarder à dresser des programmes de recherche, à imaginer des expériences cruciales ? on n'a qu'à puiser au tas...

Et voici que s'ouvre aux nouveaux « conquistadores » un immense domaine, qui unit à l'attrait de la nouveauté celui du mystère : bientôt les phénomènes électriques concentrent sur eux tout l'intérêt. Dans ces conditions, quel écho pouvaient bien trouver les réflexions d'un mathématicien (27) quelque peu dépaysé dans le domaine de la physique ? Au surplus, EULER traite la question « à la VOLTAIRE », et l'oubli où tombèrent ses critiques était certes mérité.

Enfin, les esprits synthétiques trouvaient à se satisfaire dans l'héritage grandiose légué par NEWTON. BOSCOVICH déjà, mais surtout LAPLACE crurent voir dans le concept des forces centrales le principe d'une synthèse générale des lois de la Nature; la théorie de la gravitation, la loi des forces électriques, celles de la capillarité,

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(26) Cf. P. BRUNET, *Les physiciens hollandais et la méthode expérimentale en France au XVIII^e siècle*, Paris, 1926.

(27) EULER, *Lettres à une princesse d'Allemagne*, Pétersbourg, 1786; lettres XVII et suivantes (vol. I).

la théorie corpusculaire de la lumière se groupaient autour de cette idée générale d'une manière qui pouvait paraître extrêmement satisfaisante : c'est surtout le développement de cette doctrine que LAPLACE a en vue dans sa magistrale *Exposition du Système du Monde*. La théorie du discontinu y atteint son apogée, — apogée que devait suivre de bien près la ruine.

(*Liége*). L. ROSENFELD.

The Ch'ou-Jen Chuan of Yüan Yüan *

The interesting article by Père Louis Van hée which appeared upwards of a year ago in *Isis* (8, 103-18) contains many statements to which no Sinologue could object, and for which all will be indebted to this learned Jesuit scholar. There are, however, certain other statements to which exception must be taken as giving a wrong impression of certain phases of the development of Chinese mathematics, and it is the purpose of this article to call attention to these features.

In the first place the title of the work is translated as « Biographies of Mathematicians », whereas the text relates almost exclusively to astronomers in general and particularly to those concerned with the regulation of the calendar, the lives of mathematicians being relegated to an appendix. This fact, indeed, is set forth by the author himself in his preface.

The expression ***Ch'ou-Jen*** seems originally to have meant land surveyors. The ideograph for ***ch'ou*** consists of two parts, — ***t'ien*** and ***shou***, — the former referring to cultivated land and the latter to man's age, counting of age, and sometimes merely to counting, as apparently in this case. With this meaning of « land-counting » or « land-surveying », ***ch'ou jen*** came to mean « land-surveying-men » or « land surveyors », and then « surveyors », and finally surveyors of the heavens, — astronomers. If this interpretation is correct, the ideograph ***ch'ou*** may be considered as akin to the Greek word from which comes the English geometry (earth measure). The interpretation which Yüan Yüan himself gives and which also appears in an appendix by Tan Tai are evidently quite untenable.

It should also be observed that Yüan Yüan passed the examination mentioned at the age of twenty-five instead of thirty-five.

(*) The writer wishes to acknowledge his indebtedness to Professor David Eugene Smith for assistance in revising this article for publication.

Furthermore his criticism on SUN-TZE is erroneously translated on page 106; he does not say that « many unnecessary details appear in his work, » his meaning being that his works are liable to have interpolations.

As to CHIA HÊNG (page 106), *Yeh-shih-yüang Tsang-shu-mu* is erroneously rendered by giving the meaning of the last four characters, the first two being disregarded. The six ideographs indicate a list of books owned by the Yeh-shih-yüan.

The expression *Chu-suan kê-chüeh* should not be translated « a rhymed verse on the abacus ». It means division verses to be applied to the abacus.

On page 107 eight scholars are listed as belonging to the Ch'in Dynasty (205-317), but YÜAN's work gives a ninth person. The name of the person mentioned is not T'SU TSU SUNG, but YÜ SUNG. T'su Tsu is a common noun indicating relationship.

TSU CH'UNG-CHIH's value of π, $\frac{355}{113}$, is given in the Sui-Shi. If there was any interpolation, it must have been made before 1600, for the work was then very widely distributed. Moreover, there is an early copy of the work in the Seikado Library, Tokyo, printed from blocks in the Mongol dynasty and revised about 1530. In this there appears the passage in question, this part of the work undoubtedly belonging to the period of YÜAN. The matter is, therefore, entirely clear.

The ancient description of TSU's south-pointing vehicle is very incomplete, and so it was impossible for YÜAN to have access to any detailed account of it. We are quite certain, however, from the researches of Messrs. HASHIMOTO and MOULE, that it was a mere mechanical device,without any connection with the mariners compass.

TSU's work on the circle and his son's cubature of the sphere represent the highest development of native Chinese geometry, and they seem to have been the culmination of the general progress in this science through a period of about five centuries. If TSU's circle measurement is to be looked upon as a later interpolation in the manuscripts, then all these accounts must be equally unreliable. Unless this sweeping denial is admitted, Père VAN HÉE's arguments in connection with this development must be looked upon as lacking in rigor.

Father VAN HÉE's remarks on the Supplement of CHU KÊ-PAO

also seem open to serious question. The numbers assigned to names (page 116) do not agree with Chu's text. The names given are those that are considered in the first book, covering an age already discussed by YÜAN and LO. More important and able scholars belonging to the same period had already been discussed in earlier works, but there are certain mathematicians of note, living after the ages considered by his predecessors, who are mentioned in CHU's later books.

While the Chinese feeling of superiority is obvious in the works above mentioned, this is only a natural result of the old-time culture. It appears in their name for the country, Chung-Hua, usually translated as Middle Kingdom, but more properly as Central Culture. It also is seen in the historic fact that the effect of the introduction of Western mathematics and astronomy in the sixteenth century, while at first very notable, was lost to a considerable degree a hundred years later. Not only did it meet with no encouragement from the traditionalists, but it was received under strong protest. Its effect was the encouragement of the study of the ancient classics rather than that of the introduction of new ideas from European sources. It was in this period of reaction, or of protest against Western science, that YÜAN wrote. He was not a specialist either in the domain of astronomy or in that of mathematics; but he was a philosopher and a man of general culture, and as such he was familiar with the traditional, classical, native mathematics of his own country. He may therefore be taken as a worthy representative of Chinese culture in the rather stagnant period between the introduction of Western learning by the early Jesuit fathers and its renaissance in the middle of the nineteenth century.

These circumstances explain how it was that YÜAN and his contemporaries were influenced to believe that the Occidental algebra developed from early Chinese sources. It was possibly with the desire to obtain the good will of the people that this belief was encouraged to a considerable extent by certain European scholars who were at the court of the emperor K'ANG-HSI, who told YÜAN that the word 'algebra' meant « a method originating in the East », — a fact established by MEI WEN-TING's grandson.

Father VAN HÉE expresses doubt as to whether the algebraic symbols and notation of China were influenced by Hindu or

Arab practice. This, however, is a matter of no moment, since the algebraic operations were carried out by means of calculating rods, the red indicating positive coefficients and the black representing negative ones. This particular type of mechanical calculation by the aid of rods was an essential feature of Chinese algebra. It is not found in other countries except where, as in Korea and Japan, it was derived from Chinese sources.

The learned Jesuit father is unquestionably correct in his view that the scholars of China did little for mathematics during the long period of their history, even though further research may reveal abilities not at present apparent. The evidence of a certain amount of geometric knowledge as contained in the *Nine Sections*, for example, was not adequately recognised even by the mathematicians who, in the thirteenth and fourteenth centuries, did so much for algebra. Even after EUCLID became known through the efforts of Father RICCI, Chinese mathematicians failed to grasp its significance. For this reason Father VAN HÉE has some sanction for his sweeping assertion (page 118) « Despite finesse and ingenuity their geometric mind is totally lacking. Rigorous exactness and ability for serious research are not to be numbered among the gifts of the gods. »

In spite of this fact, however, it should in all fairness be stated that the future is hopeful, and that the younger generation gives promise of developing, as the Japanese have done, a school of mathematical thought that will do great credit to the country.

(*University of Tokyo*). YOSHIO MIKAMI.

Notes and Correspondence

Queries and Answers.

Edited by TENNEY L. DAVIS (Mass. Institute of Technology, Cambridge, Mass.)

Answer No. 6. — I am puzzled by Professor DAVIS's Query 6 *(Isis*, 9, 425). I don't know why the *seventh* verse of the *third* chapter of the Revelation is a coincidence. But I do know that « verse seven » had no meaning for ROGER BACON, nor for generations after him. It was only ROBERT STEPHEN in the sixteenth century who divided the New Testament into our unhappy verses and published them in his Geneva Greek Testament of 1551. Before his time the nearest had been A. B. C. D. down the margin like our present Greek texts of PLATO. A nineteenth century Vulgate, which I have, still gives both these divisions — STEPHEN's verses and A. B. C. D. sections. Professor DAVIS can read all about this in SCRIVENER's « Plain Introduction to the Criticism of the New Testament », chap. III, § 10, vol. I, pp. 69 ff. of the fourth edition, 1894.

(Hartford, Conn.). DUNCAN B. MACDONALD.

Query No. 11. — ***The sea with a double bottom.***

HENNING LARSEN's essay entitled Tvíbytna *(Scandinavian notes and studies*, vol. 9, 18-20, 1926), has drawn my attention to a mediaeval conception entirely new to me. I would like to know whether it is equally new to other mediaevalists.

The most interesting Icelandic MS. of the Royal Irish Academy (23 D 43), edited by HENNING LARSEN but as yet unpublished, contains the following brief chapter on the depth of the sea (I quote LARSEN's translation, the Icelandic text may be found in his paper above-mentioned).

« Where the sea is deepest, it is nine hundred fathoms to the stone base. But below the sea is a stone base of sixty (fathoms), and below the stone base is a sea of sixty (fathoms), and below the sea is a stone base of a nail's thickness. »

In his commentary LARSEN refers to the Icelandic word tvíbytna (plural tvíbytnur), meaning « a bottomless lake or pit, in popular belief,

or thought to be in hidden connection with the sea », and also to the name of a Swedish lake Tväbottnetjärnen, the lake with two bottoms.

The Icelandic MS. dates from the second half of the fifteenth century, but much of its contents can be traced back to the Salernitan knowledge which had been introduced into Scandinavia chiefly by HENRIK HARPESTRAENG (first half of thirteenth century). However this notion of a sea with a double bottom seems to be specifically Scandinavian. In particular I do not remember having found it in any Salernitan writing.

February 14, 1928. GEORGE SARTON.

Reviews

H. E. Stapleton, the late R. F. Azo, and M. Hidâyat Ḥusain. — *Chemistry in 'Iraq and Persia in the tenth century A. D.* Memoirs of the Asiatic Society of Bengal, vol. 8, pp. 317-418, Calcutta, 1927.

The first two authors of this very important memoir are not unknown to students of mediaeval chemistry, or at any rate ought not to be unknown, for they had already published in the same series three valuable papers : Sal-ammoniac, a study in primitive chemistry (vol. 1, pp. 25-41, 1905); Alchemical equipment in the eleventh century (vol. 1, pp. 47-70), containing the text of an alchemical treatise by AL-KÂTHÎ, with analysis and discussion (see my *Introduction*, vol. 1, p. 723); An alchemical compilation of the thirteenth century (vol. 3, pp. 57-94, 1910). H. E. STAPLETON is principal of Presidency College in Calcutta; his two oriental collaborators are teachers of Arabic, — AZO was instructor in Arabic, Board of Examiners Office, Fort William; M. HIDÂYAT ḤUSAIN, Shams-ul-'Ulamâ', is professor of Arabic in Presidency College. Though this is not stated in the preface, I assume that AZO and ḤUSAIN's shares in this work were primarily philological, and that we owe more specially to STAPLETON the scientific interpretation of the texts in the light of occidental chemistry.

The present work is a very important contribution to the study of Arabic chemistry, though it is not by any means final, but rather in the nature of materials which will need further study. Thanks to the independent efforts of STAPLETON in Calcutta, JULIUS RUSKA in Berlin, and E. J. HOLMYARD in Bristol, our knowledge of Arabic chemistry has progressed considerably within the last ten years, and if their admirable activity continues at the same rate (or perhaps at an increasing rate with the help of disciples) we may expect to have a good knowledge of the subject within the next twenty or thirty years. Our present knowledge, it must be admitted, is still very fragmentary and uncertain.

The main texts studied are the two following : (1) AL-RÂZÎ's Madkhal al-ta'lîmî (Instructive introduction), probably composed c. 900 or before. The Arabic text is edited from the unique MS. belonging to the Nawwâb of Râmpûr (5 1/2 pp., equivalent to about 12 ordinary octavo pages). This text is also published in English translation.

(2) AL-RÂZÎ's Kitâb al-asrâr (Book of secrets). This larger alchemical

treatise, composed c. 920, is divided into three discourses. The first two discourses, dealing respectively with Substances and Instruments, are completely Englished; this is followed by fragments translated from the third discourse. The Kitâb al-asrâr is the Liber arcanorum or Liber secretorum Bubacaris known to Latin mediaevalists. The translation is made from five Arabic Mss. with occasional references to the Latin text. (1)

The interpretation of these two texts of the end of the ninth century and the beginning of the tenth is made easier by the translation of two other texts, one somewhat later and the other, earlier.

(3) The chemical section of the Mafâtîḥ al-'ulûm (Keys of the sciences), an encyclopeadia compiled c. 980 by MUḤAMMAD IBN AḤMAD AL-KHWÂRIZMÎ. The authors of this English translation were apparently unaware of the existence of a German one by the late EILHARD WIEDEMANN (1911; see my *Introduction*, vol. 1, p. 660)

(4) Fragments of the Kitâb usṭuqus al-awwal (First book called the element of the foundation) of JÂBIR IBN ḤAIYÂN (second half of VIIIth century)

To these translations are added very elaborate notes, dealing with textual, archaeological or scientific difficulties, and a long introduction.

What are the scientific contents of these documents and chiefly of the first two ascribed to AL-RÂZÎ ? They contain, first of all, a very remarkable classification of chemical substances. I cannot do more than sketch it. AL-RÂZÎ divided all chemical substances into fundamental substances ('aqâqîr) and derivative substances. The first group was classified into : (a) earthly, (b) vegetable, and (c) animal. The earthly substances were, in their turn, divided into six groups : spirits, bodies, stones, vitriols, boraces, salts. He distinguished four spirits : mercury, sal-ammoniac, arsenic sulphide, sulphur; seven fusible « bodies » or metals : gold, silver, copper, iron, tin, lead, and khârṣînî. For a special discussion of the nature of khârṣînî, see chapter 7, pp. 405-408. The authors conclude that it was possibly zinc. Another suggestion was made by J. R. PARTINGTON in *Nature* (vol. 120, p. 243, 1927) — the identification of khârṣînî with mercury.

In the second place, they give us descriptions of instruments and apparatus, at least thirty-seven types. These are dealt with in two groups : (1) instruments for melting metals; (2) those for the manipulation (tadbîr, pl. tadâbîr) of substances generally. The second group includes e.g., the cucurbit (qar') and alembic (ambîq) with a delivery tube. Four kinds of ambîq are mentioned.

STAPLETON's commentary on the alembic was new to me. He suggests

(1) J. RUSKA is preparing a critical edition of the Arabic text.

that it was probably derived from the cupping-glass (miḥjamah) — from the Greek form of cupping-glass, nipple-shaped with lower half of narrower diameter, and hole at the top. « The introduction of a model of the cupping glass into alchemy was almost certainly due to magical association between living bodies and those of inorganic (as well as organic) origin. The cupping glass removed the blood in which the soul of the person was supposed to reside : while on the other hand the spirits of both inorganic and organic substances when heated were collected in the alembic. »

Finally, they describe various alchemical processes. These processes imply a theory, of which it is worth while to recall the fundamental principle (see pp. 326-327).

« From AR-RÂZÎ's almost complete silence on the subject of the 'Mercury-Sulphur' theory of the metals in both the Kitâb al-asrâr and the Madkhal, it is possible that he did not accept the teachings of his Master JÂBIR IBN ḤAYYÂN on this point; but he certainly followed JÂBIR to some extent in the alternative form of the theory, whereby substances were looked upon as being composed of potentially active matter (jasad) in combination with various proportions of 'Spirit' (rûḥ) and 'Soul' (nafs). Believing, as he apparently did, that the essential substance (jawhar) of all matter is the same, all that was necessary to effect transmutation was to bring about various changes in the proportions of the ingredients of any substance — probably in the direction of increasing the proportion of 'Spirit' (or colouring principle) and 'Soul' (oily or combining principle). This, in ordinary language, may be interpreted as meaning the removal of the excess of any constituent which was regarded as an impurity, so that obviously the first step was to purify the substances which it was decided to use as materials for the preparation of the two precious metals, viz.: gold, the metal of perfect composition, and silver, which was only to a slight degree less perfect. Then followed processes designed to reduce the purified substances to such a degree of disintegration and fluidity that their penetration into other bodies with which they were mixed was likely to be facilitated : the admixture of the substances, thus disintegrated, in the proper proportions : and finally the removal from the mixture of dissolved, or 'cerated,' substances of the excessive amount of moisture, or the element of water, which they had temporarily acquired, so as to bring them back again to the solid state. »

The main merit of AL-RÂZÎ's work, as compared with other alchemical writings, is « his rejection of magical and astrological practices, and adherence to nothing that could not be proved, by experiment and test, to be actual fact. In alchemical practice he tore away the veil of mysticism with which even JÂBIR had continued to conceal from public view the mass of chemical facts that had gradually accumulated in the Near East up to the middle of the eighth century. »

This leads us naturally to discuss the springs of AL-RÂZÎ's knowledge. The main one is to be found in JÂBIR's writings. The latter were partly derived from Hellenistic sources, and also possibly from Chinese and

Mesopotamian sources. With regard to the Chinese origin, i.e., KO-HUNG's *Pao-p'o-tzu* (first half of fourth century; see my *Introduction*, I, 355), STAPLETON is far too dogmatic. This whole matter needs investigation almost from the bottom up. The Mesopotamian or Ḥarrânian (Ṣâbian) origin is far more plausible. STAPLETON's argument in defense of that origin is based partly upon the mention of khârṣînî (zinc ?) among the metals, and upon other facts which it is not possible to recite here. This argument is much easier to accept now than it would have been a few years ago, because the recent investigations of R. CAMPBELL THOMPSON (1925, *Isis* 9, 147) and H. ZIMMERN (1925, *Isis* 9, 547) have made us realize the importance of early Babylonian chemistry. STAPLETON's conclusions on this point are worth quoting.

« All these items of evidence appear to point clearly to Ḥarrân as another and most important source of AR-RÂZÎ's knowledge, and we are therefore led to the final conclusion that AR-RÂZÎ relied mainly on the temple science of the Ṣâbians of Ḥarrân for materials whereby he could check and, where necessary, modify the statements of his Master JÂBIR IBN ḤAYYAN. If this thesis be accepted, and if, moreover, we recall the meaning of the word khârṣînî (arrowheads of China, otherwise known as ḥadîd aṣ-ṣînî, or Chinese iron) we may further visualise Ḥarrân — the ancient Carrhae, and traditional birthplace of the ultimate founder of three of the world's greatest religions — as the focus at which had collected, and from which was again disseminated, all the knowledge of the ancient East. Lying as it did on the direct road between Syria and the Far East, as well as being the spot where the high road from Asia Minor, through the Hittite frontier-outpost Carchemish, joined the Damascus-Nineveh road, it is easy to understand how, on the one hand, it may, as the name khârṣînî indicates, have had, at some period of its history, an intimate connection with China, while, on the other, as the cult of Hermes and Agathodemon indicates, Ḥarrân certainly established a close relationship with both Greek as well, probably, as the most ancient Egyptian civilisation. As two of us pointed out in a previous paper the very name in Chaldaean was taken, in the time of the tenth century bibliographer AN-NADÎM, to indicate that Hermes was the High Priest of the Temple of Mercury in Babylon; while he was believed to have subsequently moved to Egypt where he died and was buried under the Great Pyramid, after revealing to mankind the Art of Alchemy. We need not enter into a discussion as to the precise truth of this attribution of the original civilisation of Egypt to early Mesopotamian (i. e. Sumerian) civilisation, though it more or less agrees with the present views of Egyptologists. The main point to emphasize is that, in all probability, Ḥarrân was the meeting place of all the civilisations of the ancient world, Greek (and even Minoan), Hittite, Egyptian, Mesopotamian, Persian and Chinese, and that, ultimately, through Ḥarrân, this synthetised knowledge passed on to the Arabs, and thence into the ken of the modern world. »

STAPLETON's views on Ḥarrânian culture may be compared with those expressed in my review of WALTER SCOTT's *Hermetica* (*Isis* 8, 345); they are very interesting, but the reader will please bear in mind their speculative nature.

There is still one point of the author's conclusions which deserves emphasis, namely, the one concerning the possibility of an Indian influence. I quote two extracts of his memoir relative to this (p. 343; p. 402).

« With regard to the extent and influence of Indian alchemy, previous association with Sir P. C. RÂY as our valued colleague would alone have led us to extend our enquiries in the hope of supporting his views on the subject. We regret, however, that we have been forced to conclude from a comparison of the facts that are brought to light in this paper with those given in the two volumes of his 'History of Hindu Chemistry', that the earlier, and possibly autochthonous, system of Indian alchemy based almost entirely on the use of vegetable juices, was superseded sometime between 500 and 1000 A. D. by a system of external origin which was primarily based on the use of mercury. Far from discovering any corroboration of the theory that Indian thought radically influenced the development of Western alchemy, we find AR-RÂZÎ — who was acquainted with both SUSRUTA and CARAKA, and, possibly, even made use of them in his medical works — curtly dismissing the possibility of vegetable alchemy in the sentence 'The Sages paid very little attention to vegetable substances and very seldom used them (in alchemy).' We believe that when all the facts have been reconsidered — particularly those in relation to the now-proven use of mercury in the religion and alchemy of Mesopotamia and China from at least the beginning of the Christian era to the time of AR-RÂZÎ — it will be necessary to admit that most of the knowledge regarding metallic and inorganic chemistry that has been so carefully collected by Sir P. C. RAY from Indian treatises on alchemy actually originated from outside India. » « ...the use of mercury must have been introduced into India from elsewhere. This is proved by the fact that quicksilver is nowhere found native in India, and that it is explicitly stated to have been brought from the country of Darada, or Parada, somewhere outside of India. On the other hand, mercury and its most important compound, mercuric sulphide, was known and used in Europe, the Near East, and China, for hundreds of years before the first mention of it appears in Indian medical works. In China, particularly tân shâ, or mercuric sulphide, was regarded as the 'Elixir of Life' from at least 200 B.C. (vide HANBURY, 'Notes on Chinese Materia Medica,' *Pharm. Journ.*, II (1860-61), p. 114). It is all the more necessary to emphasize this, as very recently Sir P. C. RAY, in strange disregard of the mass of published work on the subject, including the striking evidence of the actual texts of his own 'History of Hindu Chemistry,' has again stated that the knowledge of pharmacy which the Arabs brought to Europe — especially the use of mercury and its chief compound, mercuric sulphide — was derived from the Hindus (vide 'Makers of Modern Chemistry,' p. 90). »

This long analysis has not by any means exhausted the rich material contained in this memoir, but I have said enough to underline its importance. Every historian of early chemistry will have to refer to it. Its only blemish is the absence of a glossary, an absence which is especially regrettable because of the great number of technical terms, many of them unusual, which are mentioned. Aside from that, there cannot be anything but praise for this work, even if one cannot yet fully share the author's enthusiasm for AL-RÂZÎ. To compare the latter with GALILEO

and ROBERT BOYLE is not yet warranted, but if such comparison should stimulate the further investigation of AL-RÂZÎ's writings and of other Arabic treatises on chemistry, we would be the last to complain.

GEORGE SARTON.

Avicennae ***De congelatione et conglutinatione lapidum.*** Being sections of the Kitâb al-shifâ'. The Latin and Arabic texts edited with an English translation of the latter and with critical notes by E. J. HOLMYARD, Head of the Science Department, Clifton College, Bristol, and D. C. MANDEVILLE, Clifton College. IX + 86 p. Paris, PAUL GEUTHNER, 1927.

No Greek text has ever been found of the book on metals or on stones which ARISTOTLE distinctly promised in the third book of the *Meteorologica*. On the other hand a Latin text, *Liber de mineralibus* ARISTOTELIS, has long been known and considerably discussed. F. DE MÉLY (1894) and others considered it a translation of a genuine Aristotelian writing, others asserted that it was not Aristotelian but Avicennian. The truth of the matter seems to be that the *Mineralia* is partly a direct translation and partly a summary of the alchemical sections of the *Kitâb al-Shifâ'* (Book of healing) which IBN SÎNÂ composed c. 1022. More specifically : « The Latin rendering is divided into three chapters, viz. *de congelatione et conglutinatione lapidum* (a title by which the whole work is often known); *de causa montium*; and *de quatuor speciebus corporum mineralium.* The first two of these are translations, full or abridged, of section 1 of Discourse 11 of subject (fann) V of the physics of the *Shifâ'*. The third, *de quatuor speciebus* is a translation of section 4 of the same Discourse. Fann V as a whole consists of two Discourses (maqâla) upon meteorological phenomena understood in the Aristotelian sense of the term, sections 1 and 4 dealing with topics which ARISTOTLE would no doubt have treated in the fourth book of his *Meteorologica* if he had ever completed it. »

It will be recalled that the first three books of the *Meteorologica* were translated by GERARD OF CREMONA from the Arabic; the fourth book was translated from the Greek by HENRICUS ARISTIPPUS. To the fourth book were added the three chapters which form the subject of the present edition, and those chapters were translated by ALFRED OF SARESHEL c. 1200 (rather before than later).

To indicate the scientific interest of IBN SÎNÂ's mineralogy, it will suffice to quote the following paragraph from the introduction (p. 11) : « IBN SÎNÂ's opinions upon the formation of stone, rocks and mountains are remarkably interesting, in that they show an astonishingly accurate insight into geological phenomena. They are so clearly and concisely expressed that we have felt it unnecessary to give a synopsis, preferring that IBN SÎNÂ should be allowed to speak for himself. Similar remarks

apply to his theories upon the nature of minerals, and particularly to his ruthless criticism of the alchemists and their attemps to transmute the base metals into gold. On the latter subject he was taken to task by the celebrated vizier AL-ṬUGHRÂ'Î, who wrote his *Ḥaqâ'iq al-istishhâd* with the definite aim of refuting the heretical opinions of the *Shifâ'*. The arguments of the *Ḥaqâ'iq al-istishhâd* are of the usual type, so that no good service would be performed in reproducing them here. IBN SÎNÂ appears to have made up his mind only late in life; it is possible that at an earlier period he actually wrote books in favour of alchemy. However this may be, he had, in the *Shifâ'*, given the alchemists a blow the repercussions of which were felt throughout many succeeding centuries—the passage beginning *Sciant artifices alchimiae* is quoted innumerable times in mediaeval alchemical literature. »

The present publication contains a critical edition of the Arabic text by HOLMYARD, a copy of ALFRED's translation, and an English translation of the Arabic text. A number of valuable notes, philological and technical, are added to this translation. My only regret is the lack of a technical glossary. There is no excuse for omitting it. The editor could have compiled it in a short time, and would thus have saved considerable time and trouble to the scholars using his book or planning to edit similar texts. It would have hardly added to the cost of this otherwise excellent publication, and would have materially increased its usefulness. It is foolish to omit a thing which costs little and produces much. The reference to IBN SÎNÂ's Kitâb al-ḥudûd is a poor consolation for the scholars who can not easily obtain the Arabic text, nor even consult ALPAGUS's Latin translation in the Venetian edition of AVICENNA.

GEORGE SARTON.

Marco Polo. — *Il Milione*. Prima edizione integrale a cura di LUIGI FOSCOLO BENEDETTO sotto il patronato della città di Venezia (Comitato Geografico Nazionale Italiano, Pubblicazione N. 3). CCXVII + 283 pp., ills., (part colored), index. LEO S. OLSCHKI, Florence, 1928.

This new edition of MARCO POLO constitutes the third number of the important *corpus* of Italian travelers now being published by the Comitato Geografico Nazionale Italiano (1). It forms a magnificent volume

(1) The first two numbers are R. ALMAGIÀ, « L'Italia » di GIOVANNI MAGINI e la cartografia dell'Italia nei secoli XVI e XVII, 183 pp. 9 maps, Società anonima editrice FRANCESCO PERRELLA, 1922 (see *Isis*, 6, 164) and a coöperative work, L'opera degli italiani per la conoscenza dell'Egitto e per il suo risorgimento civile ed economico : scritti di vari autori raccolti e coordinati a cura di ROBERTO ALMAGIÀ, XV + 200 pp., index, Provveditorato generale dello stato libreria, Roma, 1926.

(35 × 25 cm.), clearly printed on good paper and illustrated with reproductions from illuminated manuscripts (some in color).

It is hardly an exaggeration to state that no more fundamental piece of research has ever been undertaken in the entire field of the history of geography. We have here a critical text of the *Milione*. An elaborate introduction of over 200 pages presents an analysis of the textual problem, revealing the deficiencies of the older editions. In this connection, even the edition of Sir HENRY YULE, splendid monument of scholarship that it is, does not escape severe stricture. YULE and other specialists in questions relating to MARCO POLO have been more proficient in Oriental geography and history than in Romance philology and textual criticism. Hence their work has, in places at least, been built upon foundations of sand; as Professor BENEDETTO says : « treasures of erudition have been thrown away in the illustration not of the thought of MARCO POLO himself but of the errors of his copyists. » YULE's influence in certain respects has even been positively detrimental, in that it has given rise to the illusion that there was little or nothing more to be done.

MARCO POLO, as is well known, was captured and imprisoned by the Genoese after his return from Asia. A fellow prisoner, whose name BENEDETTO believes to have been RUSTICHELLO (not RUSTICIEN, as hitherto supposed) of Pisa, wrote down the traveler's narrative in French. The picturesque story of POLO's having dictated his adventures seems to be wholly without foundation; Professor BENEDETTO thinks it more likely that RUSTICHELLO made use of POLO's notes.

To what extent do the texts of existing manuscripts and early printed editions correspond to the original version written by RUSTICHELLO? Unfortunately the very oldest extant French manuscripts are removed from this original by several links missing from the chain of descent — how many it is unknown. Furthermore, in certain Latin translations statements are found for which MARCO POLO himself was undoubtedly responsible but which do not occur in the French manuscripts. The whole question is enormously complex, but of sufficient importance to justify a brief analysis, even at the risk of over-simplification.

One of the most famous POLO manuscripts, written in old French « profoundly and variously contaminated by Italian influences, » is that of the Bibliothèque Nationale, Paris, No. 1116 (Anc. 7367). Here the phraseology in many passages closely resembles that found in certain Arthurian romances known to have been the work of RUSTICHELLO of Pisa. Identical words and turns of expression are often employed, as, for instance, those describing such very different occurrences as Sir Lancelot's arrival at King Arthur's court and that of MARCO POLO at the court of the Grand Khan. Other passages reveal a Venetian impress and are probably to be ascribed to the direct influence of the traveler

himself. This text, designated F by BENEDETTO, was inaccurately transcribed by J. B. G. ROUX DE ROCHELLE in the edition published by the Société de Géographie of Paris in 1828 and has subsequently been known as the Geographic Text. BENEDETTO prints it as the basic text in his edition.

There is another important group of French texts (BENEDETTO's FG) derived from a fourteenth century version—a sort of translation into « more orthodox » French made by one GREGORY. Certain manuscripts in this group include a statement that the copy from which they were adapted had been received in Venice directly from MARCO POLO himself by THIEBAULT, Seigneur de Cepoy, in 1307. In view of the fact that elsewhere in this same text the date of the original composition is given as 1298, the argument was elaborated by PAULIN PARIS in the middle of the last century that the copy on which GREGORY based his adaptation was a « second edition revised and corrected » by MARCO POLO and that FG was thus a closer approach to POLO's own thought than any other text, including F. G. PAUTHIER accepted this view. His well-known French edition (1865) was constructed in the main from a manuscript of this Gregorian group.

Shortly after the appearance of PAUTHIER's edition G. BIANCONI demonstrated that certain passages in FG arose from misunderstandings of passages correctly given in F. BENEDETTO surmises that both F and FG were derived from a common original model and demonstrates that FG is, if anything, farther removed from MARCO POLO's thought than F. This, of course, deprives PAUTHIER's text of its authority. Indeed, owing to the limited use of manuscripts by its editor, PAUTHIER's edition, in Professor BENEDETTO's view, is both inadequate and misleading. That it continues to be « un ingombro pericoloso », BENEDETTO observes in a footnote, is proved by the fact that A. J. H. CHARIGNON has rendered it into modern French in an elaborate edition now being published at Pekin (see *Isis*, vol. 11). Although YULE was aware of the imperfection of PAUTHIER's edition he nevertheless employed it as the basis for his English translation, correcting it in places by comparison with the Geographic Text and adding in parentheses passages from RAMUSIO's version.

The most striking part of BENEDETTO's argument is the demonstration that in the Italian version of G. B. RAMUSIO dating from the middle of the sixteenth century and in certain Latin manuscript versions which have been unknown to all previous students of the *Milione*, there is a considerable quantity of material of undeniably Polian origin not found in either F or FG. This material, therefore, must have come from an even older version than that from which F and FG were more immediately derived. RAMUSIO asserts that he used an extremely old manuscript

which was perhaps copied from the original manuscript of MARCO POLO. BENEDETTO had the good fortune to discover in the Ambrosian Library at Milan a hitherto unknown manuscript (Z) containing some of the untraced passages in RAMUSIO as well as new passages undeniably of Polian provenance. Although fragmentary, so far as it goes, Z is more authentic as well as more detailed than F.

The importance of Z is illustrated by the following circumstance. It has been wondered why MARCO POLO fails to mention Kara-Khoto, a city in central Asia near his route of march. Furthermore, it has been thought peculiar that he neglects to comment upon certain customs of the Chinese people that surely must have seemed very strange to him. Z, however, contains both a description of Kara-Khoto and a long account of Chinese manners and customs as well as much other material that is found nowhere else and can be ascribed only to MARCO POLO.

BENEDETTO uses the F version as the basis of his text, but at the bottom of each page appends all the variant or additional passages of Polian origin from Z and from RAMUSIO.

With the text thus established, let us hope for the appearance in the near future of a translation from Professor BENEDETTO's version.

(New York City). J. K. WRIGHT.

Roger Bacon. — *The Opus Majus.* A translation by ROBERT BELLE BURKE, Professor of Latin and Dean of the College, University of Pennsylvania. 2 vols. XIV + 840 pp., 8 pl. University of Pennsylvania Press, Philadelphia 1928. (Published March 2, 1928; $ 10.00).

GUY DE FOULQUES, who became pope under the name of CLEMENT IV (1265-68), had been secretary to SAINT LOUIS. The greatest part of his life was spent in France, but he was in England at the time of his election to the pontifical throne. While in Paris, and perhaps also while in England, he had many opportunities to hear of the admirable yet much-discussed activity of an English Franciscan, ROGER BACON, and soon after he had reached Rome, he addressed a letter in 1266 to the said BACON, directing him to send copies of all his writings without delay. ROGER BACON had not written much thus far, but being greatly stimulated by the Pope's interest, he proceeded to compose in full haste expositions of his doctrines; and two years later, in 1268, he dispatched three new works to CLEMENT IV, the *Opus majus*, the *Opus minus*, and the *Opus tertium*, together with a copy of an earlier one, *De multiplicatione specierum*. Unfortunately, the Pope died a few months later, and it is doubtful whether he was able to consider BACON's works, and even whether he received them.

The *Opus majus* is undoubtedly one of the greatest Latin treatises of the Middle Ages. Scholars are not agreed in their appreciation of it; uncritical praise has been naturally followed by a reaction; it is clear

now that ROGER BACON was not by any means as original and as modern as early admirers would have it. One would hesitate to repeat BRIDGES's encomium (1). « Combining the comparative study of language with a comprehensive grasp of physical science, conceiving these studies as progressive, and yet holding them subordinate to a supreme ethical purpose, the *Opus majus* surpassed any that was put before the world till the publication of the philosophical and social works of AUGUSTE COMTE. » And yet there was considerable truth in that. ROGER BACON had unquestionably some limited understanding of experimental science, and he fully realized the dangers and sterility of scholasticism, he understood the need of a better study of languages, finally he was deeply convinced of the unity of knowledge. To be sure, he was not the first to feel that unity, but the new emphasis which he laid upon it had the value of an original contribution. As he put it in his *Opus tertium* : « Omnes scientes sunt connexae, et mutuis se fovent auxiliis, sicut partes ejusdem totius, quarum quaelibet opus suum peragit non solum pro se sed pro aliis. » And then consider the architecture of his *Opus majus*; was it not splendid ? Let me just recall the main features of it.

It is divided into seven parts, as follows.

I. *Causes of error*. Four chief obstacles in grasping truth : submission to faulty and unworthy authority, influence of custom, popular prejudice, and concealment of our own ignorance — Experience and authority.

II. *Philosophy*. Theology the exposition of divine truth made through the sciences — The wisdom of philosophy is the wisdom of God — Unbelieving philosophers and poets : early Greeks, ARISTOTLE — The patriarchs and prophets — Philosophy completed by Christian faith.

III. *Study of Tongues*. Reasons why Latins should know other languages — Hebrew and Greek pronunciations — Corruptions and false interpretations of the Scriptures — Knowledge of languages necessary to the Church.

IV. *Mathematics*. Logic and science as related to mathematics — Multiplication of species as regards lines, angles, and figures — Natural action explained by geometry — The light of the stars — Climate — The tides — The infinity of matter — The shape and extent of the universe — The unity of time — Motion — Application of mathematics to sacred subjects — Astronomy — The calendar — Music — Numbers — The distances of the heavenly bodies from the earth — Astrology — The correction of the calendar — The habitable world — Known parts of Asia, Africa, and Europe — The influence of the sun, planets, and stars on the earth.

V. *Optical Science*. Imagination, the common sense and memory — Optic nerves and the structure of the eye — Perception — Light, distance, rarity of the medium, and the position, magnitude, and density of an object in relation to sight — Errors of vision : the shape of the moon, the scintillation of the stars — Reflection and refraction.

VI. *Experimental Science*. Proof through experience — External and internal experience — The utility of experimental science : analysis of the rainbow, concept

(1) *Opus majus*. Supplementary volume (London, 1900, p. V).

of an astrolabe, the possibilities of medical science — Experimental science in relation to theology.

VII. *Moral Philosophy*. The science of the salvation of man — Man's duty to God, to his neighbor, and to himself — The meaning of God — Angels — The immortality of the soul — Four hindrances to a knowledge of eternal life : sin, care of the body, trammels of the sensible world, lack of revelation — The worship of God — Laws and statutes regulating human relations — Personal conduct — Twelve virtues according to ARISTOTLE — Other definitions of virtue — Discourses on sin — Contempt for prosperity and sensual pleasures — Remedies for anger — Endurance of adversity — Thoughts from SENECA and OVID — Comparative religions — Essence of the First Cause is infinite — CHRIST the perfect lawgiver — Acceptance of the Sacrament.

Considering the importance of this work it is very surprising that it remained unpublished until 1733, when SAMUEL JEBB gave an incomplete edition of it (London, 1733). An improved edition appeared in Venice, 1750, but neither this nor the first edition contained the seventh part, the ethical crown of the Great Work. The English positivist, JOHN HENRY BRIDGES, gave a better edition in 1897 (2 vols.), but he had presumed on his scholarship when he undertook it, and this edition was sadly deficient in many respects. He published a supplementary volume in 1900, containing many additions and corrections, and the whole work was then abandoned by the Clarendon Press and transferred to WILLIAMS and NORGATE. The story of this disaster and of BRIDGES's noble way of repairing it as well as he could is movingly told in SUZAN LIVEING's biography of him (1926; *Isis*, 10, 208). BRIDGES's edition is unconvenient, as one is always obliged to consult the supplementary volume, but it contains a detailed analysis in English and a good index.

The English translation, now handsomely published by the University of Pennsylvania Press, was made by Dean BURKE, apparently with great care. I have compared with the original text a few passages taken at random, and have found them to be very accurate, if somewhat heavy. But one reads BACON for the sake of his thoughts rather than for his style, and one can hardly expect awkward Latin to be transformed into fluent English. This translation is followed by an elaborate index. Thus henceforth it will be very easy for English readers either to read the *Opus majus* or to refer to it, and for this we owe some gratitude to the translator and the publishers.

Yet it is a great pity that they left this work unfinished in another important respect. It is clearly impossible for an inexperienced reader to appreciate BACON's work on the basis of this translation. From this point of view, BRIDGES's edition will still be more useful to him than BURKE's version, for it contains a number of valuable notes. How can the reader know what is original to the Doctor mirabilis, and what is not ? No such translation can be deemed complete which does not

contain sufficient footnotes to indicate, however briefly, the source of each statement. Of course, this would require considerable research, but it is only when that is done that we shall consider the *Opus majus* properly edited. The University of Pennsylvania Press ought to have done that, but it is not too late yet; let us hope that it will soon give us these footnotes in a separate volume.

In short, for a proper study of the *Opus majus*, we need a new edition of the Latin text, which may be read consecutively; in the second place, the present translation must be completed by a volume of scientific notes. When that is done it will be a little easier to appreciate correctly the work and personality of BACON. At the present time there is not yet a single biography of him that is entirely satisfactory to the historian of science. All that we have is the following : EMILE CHARLES. BACON (432 pp., Paris, 1861) — BRIDGES's introduction to the *Opus majus* (1897; improved edition, published in 1914). This is valuable but insufficient. BRIDGES's knowledge of mediaeval science was rudimentary. — The BACON essays edited by A. G. LITTLE (Oxford, 1914) to commemorate the seventh centenary of BACON's birth contain very interesting materials. — LYNN THORNDIKE has devoted considerable space to BACON in his History of Magic (vol. 2, 1923, 616-691), but his account is not complete from the scientific point of view, nor is it unprejudiced. THORNDIKE is the leader of the anti-Baconian reaction, but I believe he has gone too far. There are many other studies dealing particular subjects (see my *Introduction*, vol. 2), but we need a synthesis; we need it not only for the sake of BACON, but, even more, to make possible a correct judgment of the knowledge available in the second half of the XIIIth century.

The most urgent task is to complete this excellent translation by the scientific notes without which there is not one scholar in a thousand who can really understand BACON's *Opus majus* and appraise its true merit.

GEORGE SARTON.

William Romaine Newbold (1865-1926). — *The Cipher of* ROGER BACON. Edited with foreword and notes by ROLAND GRUBB KENT. XXXII + 224 pp., 33 pl. Philadelphia, University of Pennsylvania Press, 1928 (Published March 23, 1928; $ 4.00) .

The well-known bookseller, (1) WILFRID M. VOYNICH, purchased in or about 1912 « in an ancient castle in Southern Europe » the manuscript which is the subject of the present publication. This manuscript was given in 1665 (or 1666) by MARCUS MARCI of Prague to ATHANASIUS

(1) The author calls him « bibliophile. » Well, I trust Mr. VOYNICH is a bibliophile, but he is primarily a bibliopole. The use of the word bibliophile in this case is deliberately misleading.

KIRCHER. MARCI's Latin autograph letter contained the following statement : « Dr. RAPHAEL, tutor in the Bohemian language to FERDINAND III, then King of Bohemia, told me said book had belonged to the Emperor RUDOLPH and that he presented to the bearer who brought him the book 600 ducats. He believed the author was ROGER BACON, the Englishman. On this point I suspend judgment; it is your place to define for us what view we should take thereon. » As the margin of the first page bears the name of JACOBUS DE TEPENECZ, we may assume that the Ms. was once the property of this Bohemian scientist, who, before 1608, was known as HORCICKY (or SINAPIUS). JACOBUS may have obtained it from the emperor RUDOLPH II, but this is a mere guess; the history of this Ms. before 1608 is entirely conjectural. It is a small quarto (nine by six inches) of 246 pages, written in cipher, and containing many illustrations.

« To judge from the drawings, the contents of the manuscript fall into five divisions. The first and largest section contains the equivalent of 130 pages, 125 of which bear drawings of plants with accompanying text; this I term the botanical division. The second contains 26 pages of drawings, obviously astronomical or astrological, but of striking originality, few presenting any resemblance to the innumerable extant drawings relating to the same subjects. The drawings are accompanied by numerous legends, but little continuous text. The third section is still more strikingly original in character; it contains 4 pages of text and 28 of drawings, to which no parallels of any sort are known. Some persons perhaps would term them 'weird,' 'bizarre,' 'uncanny,' but neither these nor any other adjectives seem to me appropriate. Yet, strange as they are, they are not lacking in artistic quality; the nude little female figures with which every page is peopled are rudely drawn indeed, but there is about them a fresh vividness, an expressiveness, which places them at a wide remove from the stiffly conventional figures of contemporary miniature painting. The leading topic dealt with in this section is the procedure by which the soul becomes united to the body; I term it 'biological.' The fourth division contains on 34 pages drawings of flowers, fruits, leaves, roots, and of the receptacles used by pharmacists for their drugs; it is almost certainly pharmaceutical in character. The fifth division contains 23 pages of text, arranged in short paragraphs, each beginning with a star. The 24th page of this division, the last of the manuscript, contains the Key only. »

The late Professor NEWBOLD undertook to decipher this mysterious manuscript. He was just the sort of scholar to undertake this repelling task. As his editor tells us, « even as a boy he was attracted by strange alphabets and puzzling methods of writing. He was thrilled by LAYARD's Nineveh; he copied with a stylus on soft clay a cuneiform text there pictured, baked the tablet in the kitchen oven, and buried it in a field, where some day it may be found and held as proof of an Assyrian conquest of Northern New Jersey. He taught himself to read the Hebrew Old Testament... » During the last years of his life he devoted considerable time to the BACON manuscript and to the Great Chalice of Antioch

« supposed by some to be the actual Chalice of the Last Supper, the Holy Grail of legend... » After long investigations, he concluded that the manuscript was written in characters which were themselves made up of microscopic characters, based mainly on ancient Greek shorthand. The cipher was extremely complicated but, if I understand the author's and the editor's explanations, it was rather flexible, so that a group of letters could be interpreted in various ways. For technical details I must refer the reader to NEWBOLD's book, but the following extract may be quoted to illustrate the extreme difficulty and the arbitrariness of his task.

« But such is the craft, may I say the infernal craft, of the dear old soul, that long after I had his alphabet and his system I could not read a word with any assurance that it was right. And I haven't yet mastered all his tricks, although I know a great many of them.

« *Deception* is the keynote of the whole. Nothing is what it seems to be. His beautifully written characters are all shams. They look like *a*, *s*, *m*, *n*, and so on, but they are nothing of the kind. Nearly every one is built up with amazing skill and ingenuity out of microscopic shorthand characters. He was the only man on earth possessed of a good microscope, and he relies upon it as part of his apparatus of concealment. I have long known the fact that his letters were built up out of significant elements and had been using an ordinary reading glass to help resolve them, but only about four months ago, when it occurred to me to turn a pretty strong microscope upon them, did I discover that nearly all the letters which I had been taking as wholes were really perfect nests of tiny characters »

Mark the « good microscope, » which is truly symptomatic. A scholar of NEWBOLD's type stops at nothing, — and thus we may expect him to obtain almost any results ! Witness his descriptions of two of the pages reproduced in facsimile in his book.

« Plate V. Page from the biological section : folio 78 recto. Upper corners schematized ovaries (nucleated ova); (Fallopian) tubes opened to show stream of ova descending into cavity (uterus), in which are seven souls or spirits (spermatozoa), three not yet awakened to consciousness, four expressing surprise and horror at their environment. Below, eight spermatozoa have discovered a 'nest' of eight ova and view their destined dwelling places with expressions of surprise and curiosity, not unmixed with disgust. »

« Plate VIII.... This and several other of the disks have a marked general resemblance to magnified sections of a fertilized ovum, but the resemblance in detail is not close enough to warrant identifying any one of them with any particular stage of development as seen through modern microscopes. The combination, however, of these anatomical symbols with other symbols of a different character leaves no doubt that the series as a whole is intended to symbolize BACON's theory of the development of the ovum, especially of the influences which are brought to bear upon it. BACON held that six factors are concerned in the generation of the organism : (1) the seed of the female, which supplies the matter, (2) the soul of the male which, operating through (3) the seed and (4) by means of the 'spirits,' a species of vapor or gas produced by the seed, gives form to that matter, not

however without the coöperation of (5) the soul of the female, (6) the united influence of the heavenly bodies, especially the sun, which controls the entire process. All of these factors may be recognized in the drawings. The seed of the female is represented by the cell rings in five of the disks; the male seed by an object resembling the head of a spermatozoön embedded in one of the disks (the same object occurs elsewhere in a context which requires the same interpretation); curious wave-like formations in two of the disks may well symbolize the 'spirits.' The celestial influence operates from the corners, its effects on the ovum is represented by masses of stars pouring into or massed within the disks, and by pictures of a church, a castle, and more modest dwellings inside one of the disks. It is also probably represented by symbols resembling those used in the astronomical section for the divisions of the sky, which are seen within two of the disks. The souls of the parents, which 'excrete the seed,' are not here represented but are shown on Plate VII. »

Still another page is interpreted by him as being a drawing of the great nebula of Andromeda which can « at present be detected by photographs only; it is not visible even in the most powerful telescopes. »

When a man is as utterly devoid of critical sense as NEWBOLD proved himself to be, there is no limit to the eccentricities which his mind may conceive. I do not doubt a moment his honesty; I am willing to admit that he was not a deliberate impostor, but he was undoubtedly, to put it as gently as possible, a self-deceived enthusiast. However, the most astonishing and painful thing to me is not the erratic activity of a NEWBOLD, but the readiness of so many people to be fooled by him. This is not the first example of pseudo-science or pseudo-scholarship. In every case the deception would have been almost impossible but for the unconscious complicity of a crowd of people who are so fond of mystery that they are at the mercy of every impostor or crank having enough skill, plausibility and persistence.

I have devoted far more space to NEWBOLD's work than it deserved. I have done so because my shorter note relative to it, apropos of JOHN M. MANLY's criticism (1921, *Isis* 4, 404), has apparently been insufficient. I was hoping then that this idiotic thing might be averted, but now that it has been published in book form, and so handsomely published, a new stream of evil has been started which will work mischief for ages to come. We may be sure that there will be enough cranks to continue the new kind of aberration originated by NEWBOLD,and enough misguided occultists and muddle-headed people of various kinds to stimulate them. Henceforth when we shall speak of Baconian fools, we shall have to distinguish between two groups of such fools, the Francis Baconians and the Roger Baconians.

The author of this extraordinary book, WILLIAM ROMAINE NEWBOLD, was born in 1865 at Wilmington, Delaware. He studied at the University of Pennsylvania, and became an instructor there in 1889; the rest of

his life was spent in the service of his alma mater, as a teacher of philosophy. He died in Philadelphia, in 1926. He wrote a great many papers on psychological, philosophical, philological and archaeological subjects, but unfortunately he will be mainly remembered because of his interpretation of this so-called Baconian manuscript. Thus his main bequest to mankind is not of a positive but of a negative nature, for in his opus majus he did not leave us new truths but new errors and delusions. However, we have every reason to assume that he was thoroughly honest; may he rest in peace !

More information on the author may be found in a booklet, edited by R. G. KENT, entitled NEWBOLD Memorial Meeting (30 pp., with portrait and bibliography, University of Pennsylvania, Philadelphia, 1927).

GEORGE SARTON.

Ellen Scott Davison (1864-1921). — ***Forerunners of Saint Francis and other studies***. Edited by GERTRUDE R. B. RICHARDS; with a foreword by JAMES T. SHOTWELL. XVI + 425 p., portrait. Boston, HOUGHTON MIFFLIN, 1927 (five dollars).

The largest and most important part of this book is a study of the successive waves of Christian discontent and reform which preceded the establishment of the Mendicant Orders at the beginning of the thirteenth century. These waves succeeded each other with increasing speed and strength during the eleventh and twelfth centuries. The causes were many : the slow disintegration of feudalism, the growth of cities, the appearance of new social classes; then also the slow but steady diffusion of knowledge, finally the crystallization of the Church, the culmination of its temporal power, its gradual loss of spiritual vigor. The ideals of primitive Christianity seemed more and more distant and yet the very churchmen who appeared to forget them were obliged to fan Christian endeavor in order to insure the success of the Crusades. Put all these things together : economic distress or discomfort, intellectual fermentation, conflicts between spiritual aspirations and clerical formalism, Crusading revivals. It is natural enough that many of the best men and women were inspired anew by the teachings of the Apostles and especially by the ideal of evangelical poverty. Never was the discipline of the Church more often questioned than during the two centuries which prepared the coming of ST. FRANCIS. Miss DAVISON has admirably told the main events of this period of religious fermentation. She explains the foundation of the Carthusian order in the Dauphiné, the efforts of the Good Men of Grammont in Limousin, the establishment of the Cistercian Order in Burgundy, and that of the Praemonstratensians in the Ile-de-France, the activity of ARNOLD OF BRESCIA and his followers in Rome, of the Humiliati in Lombardy, of the Poor

Men of Lyons, of the Waldensians in Piedmont, S. France, Germany, of the Cathari and their kindred almost everywhere. Her account is always based upon the best available information and contains all the needed references. It is well thought out and pleasantly written, and is inspired throughout by genuine sympathy for all concerned. She gives us incidentally excellent portraits of the main protagonists : the German ST. BRUNO; the Frenchmen ST. ETIENNE OF MURET, ROBERT OF MOLESME, ST. BERNARD, PETER WALDO; the Italian ARNOLD OF BRESCIA; even an Englishman, and a great one, STEPHEN HARDING; and this curious ST. NORBERT. the founder of the Order of Prémontré, so full of inconsistencies and yet so well balanced, who hailed from the little Duchy of Cleves. The last personality is that of ST. FRANCIS, but we are given of him only a tantalizing glimpse.

Why did ST. FRANCIS succeed while so many of his saintly predecessors were driven into rebellion and heresy? Why have the Mendicant Orders triumphed? To be sure, the Carthusians, Cistercians and Premonstrants succeeded too, but to a much smaller extent. The others failed completely. Why? After reading Miss DAVISON's clear and wise account and connecting it with my own knowledge of the subject, with my own thoughts and impressions, I have satisfied myself that ST. FRANCIS's success was due only in part to his own genius. ST. FRANCIS succeeded partly because many others had failed before him. Their failures had taught him and others what to do and what not to do. By others, I mean the Curia. By the beginning of the thirteenth century it must have been clear to the Church that the enthusiasm for evangelical poverty was too genuine and too wide-spread to be checked. The fact that it was INNOCENT III (1198-1216) who ordered the Crusade against the Albigenses may give us of him a very wrong idea. In fact he showed in these critical days an unusual amount of wisdom and fatherly kindness. He « realized that the Church, beset by enemies who fought for conscience's sake, needed to organize all of the enthusiasm and religious zeal she could command within her own ranks ». Children (and most men are children) must be assumed to be good, as long as they have not proved themselves unquestionably bad. It was foolish to drive wayward but good children into heresy. It was easier to see the faults of the clergy than to remedy them. Many of the reformers were exceedingly ignorant, and thus « doctrinaire »; it was difficult to discuss with them, yet they were good, perhaps better than their opponents. It was necessary to handle discontented Christians with considerable tact and kindness. INNOCENT III conciliated the Humiliati, or at any rate some of them; he even conciliated the more orthodox of the Waldensians, the so-called « Poor Catholics »; if he failed to conciliate the others, he proved sufficiently by his attitude that it was not

entirely his fault. Finally it was he who sanctioned the endeavors of ST. FRANCIS and ST. DOMINIC in spite of their revolutionary nature, in spite of the evident dangers which lurked in them. Thus the final triumph of the Gray and Black Friars must be credited at least in part to the spirit of toleration and the practical wisdom of INNOCENT III.

The psychological interest of this study is very great and historians of science, dealing with this period—one of the main turning points in the intellectual evolution of the West— ought to have some knowledge of it. It is partly for this reason that I have devoted so much space to a work which is more directly concerned with the development of religion than with the growth of understanding.

The author of this book was born of New England ancestry in Louisville, Kentucky, in 1864; she graduated from Wellesley in 1887, and while teaching in various schools obtained her M. A. in Western Reserve and her Ph. D. at Columbia (1907). The main part of the present volume is an expansion and revision of her doctor's thesis. She held many responsible positions in Bradford Academy, Barnard, Bryn Mawr and other schools; in the fall of 1918 she became principal of the Cooperative Open Air (Shady Hill) School in Cambridge, Massachusetts, but was obliged by an acute illness to relinquish her work. She died at Portland, Maine, on Sept. 20, 1921. The reviewer had the privilege of seeing her in Cambridge, and also in Pemaquid Point, Maine, and will ever keep of these few meetings the most pleasant remembrance. Miss DAVISON was not only an unusually good scholar, but a brave and noble woman who enriched her friends by her very presence.

The publication of this posthumous book would have been impossible but for the devoted collaboration of many friends, chiefly : Miss GERTRUDE R. B. RICHARDS who acted as editor and added many valuable notes of her own, Professor JAMES T. SHOTWELL who wrote a preface, and above all the author's sister, Mrs. WILLIAM R. BELKNAP of Louisville. The author's portrait published in frontispiece is an excellent likeness.

GEORGE SARTON.

J. D. Eisenstein. *Ozar Massaoth*, a collection of itineraries by Jewish travellers to Palestine, Syria, Egypt and other countries... with maps, notes and index. Selected and edited by J. D. EISENSTEIN, New York (Vol. I, Hebrew Text, privately published), pp. 352, 1926.

Mr. EISENSTEIN, the well-known author, and the editor of the Hebrew encyclopedia, *Ozar Israel*, has enriched Hebrew literature with a new compilation on the itineraries of Jewish travellers to various countries.

In the general introduction, the compiler hints at the travellers in Talmudic times, and gives a short sketch of their activity during the Geonic period. Brief mention is also made of the reports of the Christian

pilgrims during these two eras. Not all the itineraries of the Jewish travellers, quoted in the general introduction, are published in the book, the compiler selecting for publication the texts of such travels only as were of more literary and historical value. All in all there are twenty-four accounts of travels in the book. They are :

1. Travels of Rabbi BENJAMIN OF TUDELA . . 1165–1173.
2. Itinerary of Rabbi PETHACHIA OF RATISBON . 1175–1185.
3. Travels of Rabbi JACOB BEN NATHANIEL HA-COHEN . . . . . 12th Cent.
4. Travels in Palestine by Rabbi SAMUEL BEN SAMSON . . . . . 1210.
5. Travels of Rabbi JACOB, messenger of R. JEHIEL of Paris . . . . . 1238–1244.
6. The Routes of Jerusalem by Rabbi ISAAC HELO. 1333.
7. Letter of Travels by Rabbi ISAAC IBN ALFARA. 1441.
8. Letter of Travel by Rabbi ELIJA OF FERRARA. 1435.
9. Three Letters of Travels by Rabbi OBADIAH OF BERTINORO . . . . . 1487–1488.
10. Letter of Travel by Rabbi MESHULAM BEN MENACHEM . . . . . 1481–1483.
11. Letter of Travels by Anonymous Venetian Scholar . . . . . 1495.
12. Travels in Palestine by Anonymous writer . . 1522–3.
13. Travels of DAVID REUBENU of the Ten Tribes. 1522–5.
14. Travels of Rabbi ELIJAH OF PESARO . . . . 1622.
15. Travels of Rabbi ISAIAH HURWITZ (SHELAH). 1622.
16. Letters of Travels by Rabbi GERSON BEN ELIEZAR . . . . . 1624–5.
17. Letters of Travels by the Karaite SAMUEL BEN DAVID . . . . . 1641–2.
18. Letters of Travels by the Karaite MOSES YERUSHALMI . . . . . 1654–5.
19. Letters of Travels by the Karaite BENJAMIN BEN ELIJAH . . . . . 1785–6.
20. Diary of Travels by HAYYIM JOSEPH DAVID AZULAI . . . . . 1753–8.
21. Stories of Travel in Galilee by SIMḤAH BEN JOSHUA . . . . . 1774.
22. Travels in Morocco by SAMUEL ROMANELLI . 1786–90.
23. Letters of Travels by Dr. LAZARUS LOEWE . . 1837.
24. Diary of Travels by Lady JUDITH MONTEFIORS. 1838–9.

A special introduction precedes the text of each traveller, giving his biography, an account of his journey, and an evaluation of the historical

importance and literary merit of his composition. The annotations consist of critical remarks, textual emendations, identifications of proper names and places, and explanations of some Arabic, Latin or Italian words, etc., which are here and there employed by the traveller.

The reviewer made no attempt to go over the editor's notes systematically, but, while perusing the book, some assertions seemed to him either doubtful or erroneous. Thus *Mista'arbim* (p. 131) is not Moriscos, but persons attempting to adopt the customs of the Arabs. The word is the Arabic *Musta'ribun*, in Hebrew garb. The emendation « *bint* » for bgtn (p. 134) is very doubtful. Besides, « *bint* » means in Arabic « girl », and not « girls. » The word *ḥol* (Job 29, 18) is identified by some commentators as the phoenix, not Venus ! (p. 258).

Here and there the editor has allowed himself to omit some passages or words (cf. p. 140, p. 171, p. 248 etc.) apologizing for their omission on the ground that they were undeserving of the attention of the reader. Likewise, a drawing in the book of SIMḤAH BEN JOSHUA is also not reproduced by the compiler, on the claim that it would only perplex the reader (p. 249).

It may be said in general that the editor was too eager to emend the text. Reserved judgment, however, is always to be preferred to an arbitrary emendation.

Notwithstanding some inherent defects in the book, it must be owned that Mr. EISENSTEIN has performed a signal service to Hebrew students and those interested in medieval travel. Many of the texts being extant in rare editions only, the reader is now afforded the unusual opportunity of utilizing so many accounts at once, which heretofore had been even singly inaccessible to him.

(New York). JOSHUA FINKEL.

André Metz. — ***Une nouvelle philosophie des sciences — le causalisme de*** **M. EMILE MEYERSON.** VI + 211 p. Paris. ALCAN 1928. (Fr. 15).

Ce livre court, agréable à lire, contient un excellent exposé de la doctrine de M. EMILE MEYERSON, dont les importants travaux d'épistémologie devraient être lus et médités par tous ceux qui s'intéressent à la psychologie de l'esprit scientifique, à l'histoire des sciences, ou au grave problème de la valeur de la connaissance. — M. ANDRÉ METZ, ancien élève de l'École polytechnique, déjà bien connu par ses remarquables écrits sur la théorie de M. EINSTEIN, ayant eu l'occasion de lire des fragments de *Déduction relativiste* devint rapidement un fervent disciple de M. MEYERSON, prit connaissance de l'œuvre entière, et se proposa de répandre les thèses maîtresses de l'auteur bien au delà du public extrêmement restreint, jouissant déjà d'une grande culture philosophique, en vue duquel cette œuvre a été écrite.

M. METZ s'est surtout efforcé de présenter l'essentiel des idées de M. MEYERSON, sous une forme accessible au grand public, et particulièrement au public scientifique, si fortement interessé par des tentatives de ce genre; il serait heureux, dit-il, si le livre qu'il publie pouvait être considéré comme *une première introduction à l'œuvre de* M. ÉMILE MEYERSON. Disons tout de suite qu'il a parfaitement réussi dans son entreprise; désormais le travailleur de laboratoire, celui même qui fait profession de dédaigner la philosophie ou de mépriser la métaphysique se rendra compte sans effort, que le positivisme dérivé d'AUGUSTE COMTE qui s'étale encore bien souvent dans les préfaces de divers ouvrages scientifiques, a été vigoureusement attaqué, et victorieusement battu en brèche par les critiques auxquelles M. MEYERSON a soumis ses affirmations fondamentales, notamment la prétention de se passer désormais de la recherche des causes. Et ces critiques reproduites aujourd'hui par M. METZ avec beaucoup de conviction et de force persuasive doivent d'autant plus faire réflechir, qu'elles n'ont encore, il faut le remarquer, suscité jusqu'à présent aucune réponse sérieuse des savants qui se réclament du positivisme, que ces savants soient par ailleurs spiritualistes, matérialistes ou pragmatistes.

Nous ne pouvons ici suivre le limpide exposé de M. METZ que les travailleurs qui n'ont pas encore lu *Identité et réalité* (*Isis* 9, 470-72), *De l'explication dans les sciences* (*Isis* 4, 382-85), ou *La déduction relativiste* (*Isis* 7, 517-20), auraient intérêt à connaître, soit pour avoir une idée de la philosophie scientifique de M. MEYERSON, soit pour parvenir, ainsi préparés, à aborder l'œuvre elle même sans rencontrer trop de difficultés.

Paris. HÉLÈNE METZGER.

Twenty Third Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(*to October* 1927)

This Twenty Third Bibliography contains about 790 items, some of which have been kindly contributed by the following scholars :

R. C. Archibald (Providence, R.I.)
H. G. Bévenot (Weingarten, Württ.)
R. P. Blake (Cambridge, Mass.)
T. L. Davis (Cambridge, Mass.)
C.W. Dodge (Cambridge, Mass.)
L. Guinet (Brussels)
E. J. Holmyard (Bristol)
J.W.S. Johnsson (Copenhagen)
C. D. Leake (Madison, Wisc.)
L. Leroux (Paris)
E. O. von Lippmann (Halle)
D.B.Macdonald (Hartford,Conn.)
H. Metzger (Paris)
M. Meyerhof (Cairo)
J. Stephenson (Edinburgh)
H. Wieleitner (Munich).

An authors' index will be found at the end. For general information on this undertaking see the Prefaces to the Sixteenth and Eighteenth Bibliographies in *Isis* VII, 172-174, 1925; VIII, 526-528, 1926.

Papers and books sent to the Editor are entered into this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in its proper place, we are already rendering a real service to the author, the publisher and the learned public. It should also be noted that there is no relation between the importance of a publication and the length of the note devoted to it.

The ultimate aims of this undertaking are : 1) to establish the History of Science as an independent discipline; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies. We can not succeed entirely without their assistance, and they can help us in many ways. To serve them, as well as we can, is both

our duty and our pleasure. Critical work must be approached in a spirit of service or left untouched.

Harvard Library, Room 185.
Cambridge, Massachusetts. GEORGE SARTON.
Dec. 9, 1927.

PART I.

FUNDAMENTAL CLASSIFICATION (CENTURIAL).

IXth Century B. C.

Bickel, Ernst. Homerischer Seelenglaube. Geschichtliche Grundzüge menschlicher Seelenvorstellungen. (*Schrift. d. Königsb. Gelehrt. Ges., Geisteswiss. Kl.*). p. 211-343. Berlin, Dtsche Verlagsges. für Politik und Gesch., 1925 ISIS

Reviewed by KURT LATTE in *Deutsche Literaturzeitung*, 956-958, 1927.

(Homer). *Introduction I*, 53. SCHLIEMANN, nicht DÖRPFELD, ist der Entdecker Troja's. *I*, 55. Es fehlen die deutschen Übersetzungen (seit Voss), die weitaus die besten sind. E. O. v. L. ISIS

Mülder, Dietrich. Bericht über die Literatur zu HOMER (höhere Kritik) aus den Jahren 1920-1924. *Jahresber. über die Fortschritte d. klassischen Altertumsw.*, 207, 1-90, 171-255, 1926. ISIS

VIIth Century B. C.

Maximova, (Mlle.) M. I. Les vases plastiques dans l'antiquité (époque archaïque). Préface par E. POTTIER. Traduction par MICHEL CARSOW. Tome I : Texte, 223 p.; Tome 2 : planches. Paris, P. GEUTHNER, 1927. (160 frs.) ISIS

Ceci est la première étude d'ensemble de ces vases curieux qui constituent une sorte de transition entre la figurine de terre cuite et le vase d'argile peinte. Elle est limitée à la période archaïque (VII^e^ et VI^e^ siècles) comprenant les productions ionienne, corinthienne, proto-corinthienne, béotienne, et constituant un ensemble parfaitement homogène. Le principal intérêt de cette belle monographie pour l'historien de la science et de la civilisation c'est de prouver une fois de plus l'importance de l'Ionie, qui fut sous beaucoup de rapports l'héritière de la Crète et devint le foyer où convergèrent les influences égyptiennes et orientales. « De toutes les fabriques de la Grèce archaïque, celles de l'Ionie sont incontestablement les plus intéressantes. Le rôle de l'Ionie a été prépondérant dans l'art héllenique au VII^e^ siècle et pendant une

partie du VI^e^ siècle. C'est en Ionie qu'a pris naissance l'art hellénique qui devait par la suite atteindre un si haut degré de développement. L'art ionien des VII^e^ et VI^e^ siècles est le printemps de l'art grec, le premier éveil de l'esprit créateur purement hellénique, inconscient de sa personnalité encore, et lié aux formules millénaires de l'Orient, mais ayant déjà l'intuition de sa force, de ses buts et de ses aspirations. » G. S.

VIth Century B. C.

Hsu, C. Y. The philosophy of CONFUCIUS. With a foreword by J. PERCY BRUCE. 63 p. London, Student Christian Movement, 1926. ISIS

Karlgren, Bernhard. On the authenticity and nature of the Tso chuan. (*Göteborgs Högskolas Arsskr.* 32, 1926, 3). 65 p. Göteborg, WETTERGREN and KERBERS, 1926. ISIS

Elaborate review by O. FRANKE, *Deutsche Literaturzeitung*, 1498-1507, 1927.

Thomas, Edward Joseph. The life of BUDDHA as legend and history. XXIV + 297 p., 4 pl., and map. (History of Civilization Series). London, KEGAN PAUL, 1927. ISIS

Vth Century B. C.

Brown, Barnum. Is this the earliest known fossil collected by man ? *Natural History*, 26, 537-544, 1926. ISIS

Apropos of a milk molar of *Elephas antiquus* found in the Asclepion of Cos. G. S.

Cambridge ancient history, the. Edited by J. B. BURY and others. Volume V., Athens. XXII + 554 p. Cambridge, University Press, 1927. ISIS

Reviewed by DAVID M. ROBINSON, *American Historical Review*, 33, 93-95, 1927.

(Chinese lexicography). *Introduction I*, 110. BRETSCHNEIDER, und auch HIRT, liessen sich durch die planmässigen Fälschungen der chinesischen Autoren oft und weitgehend täuschen. E. O. v. L. ISIS

Heiberg, J. L. Alphorismer om HIPPOCRATES. Studier fra Sprog- og Oldtidsforskning, No. 7. Copenhagen 1892. J. W. S. J. ISIS

Heiberg, J. L. Det hellige Syvtal. Festkrift til C. JUEL. *Matematisk Tidsskrift*, 1925. J. W. S. J. ISIS

(Herodotos). Das Geschichtswerk des HERODOT. Neu übertr. von THEODOR BRAUN. 810 p. Leipzig, Insel-Verlag, 1927. ISIS

Reviewed by F. JACOBY, *Deutsche Literaturzeitung*, 1853-57, 1927.

(Hippocrates). Indices librorum. Iusiurandum. Lex. De arte. De medico. De decente habitu. Praeceptiones. De prisca medicina. De aere locis aquis. De alimento. De liquidorum usu. De flatibus. Edidit J. L. HEIBERG. (*Corpus medicorum graecorum*, I, 1.) XII + 146 p. Leipzig, TEUBNER, 1927. ISIS

Index verborum, p. 102-146. G. S.

(Hippokrates). Eine Auslese seiner Gedanken über den gesunden und kranken Menschen und über die Heilkunst. Sinngemäss verdeutscht und gemeinverständlich erlautert von ARNOLD SACK. VI + 87 p., portrait. Berlin, SPRINGER, 1927. ISIS

Jones, W. H. S. The doctor's oath : an essay in the history of medicine. 62 p., 2 facsimiles. Cambridge, University Press, 1924. ISIS

Scholarly analysis of the so-called « Oath of HIPPOCRATES » based upon an examination of all available codices. Facsimile and translation of the Christian variant of the Oath, Urbinas 64, fol. 116, the oldest extant version, dating from the Xth or XIth century. The perplexing « operating clause » is not found in this Christian version. « May it not be assumed that it did not belong to the original form, but was afterwards added to suit the prejudices of physicians at a certain period ? » No index. C. D. L.

Klages, Ludwig. Das Problem des SOKRATES. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 103-111, 1927. ISIS

(Scylax). *Introduction I*, 104. Der Periplus ist zweifellos unächt. ISIS E. O. v. L.

Spiegelberg, Wilhelm. The credibility of HERODOTUS' account of Egypt in the light of the Egyptian monuments. Being a lecture delivered at the fifty-fifth Congress of German Philologists and Schoolmasters at Erlangen. With a few additional notes by the translator, AYLWARD M. BLACKMAN. IV + 40 p., 2 pl. Oxford, BLACKWELL, 1927. ISIS

Unger, F. C. De groote HIPPOKRATES-uitgevers en de geschiedenis der geneeskunde. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 343-355, 1927. ISIS

Walters, Henry Beauchamp. A statuette of SOCRATES. *The British Museum Quarterly*, 1, 9-11, 1 plate, 1926. ISIS

A charming statuette acquired by the British Museum in 1925, Parian marble, 27.5 cm. high in its present condition (feet missing). It must be regarded as the earliest representation of the philosopher, dating from about the end of the fourth century B.C. It is a great work of art. G. S.

Wellmann, Max. HIPPOKRATES, des Thessalos Sohn. *Hermes*, 61, 329-334, 1926. ISIS

IVth Century B. C. (whole and first half).

(Aeneas Tacticos). AENEAS on siegecraft. A critical edition, prepared by LESLIE WHITAKER HUNTER. Revised, with some additions, by S. A. HANDFORD. Oxford, Clarendon Press, 1927. ISIS

Rivaud, Albert. PLATON auteur dramatique. *Rev. d'hist. de la philosophie*, 1, 125-151, 1927. ISIS

L'auteur pense que PLATON a cherché à faire de ses dialogues «une comédie, un drame d'idées » dans lesquels « il a voulu nous donner une impression plutôt que des leçons positives ». « Les éléments dogmatiques du platonisme n'étaient peut-être que des éléments techniques » tandis que les dialogues « contiennent sans doute moins un enseignement qu'une annonce, un programme, un manifeste en faveur de l'école platonicienne »; ils n'exposent donc pas un système, et leur objet primitif est, non pas dogmatique, mais historique. L. G.

IVth Century B. C. (second half).

(Aristotle). *Introduction I*, 128, 132. Mechanika und iv Meteorologica sind zweifellos unächt. E. O. v. L. ISIS

(Aristotle). The works of ARISTOTLE translated into English under the editorship of W. D. ROSS. Volume VII. Problemata, by E. S. FORSTER. New York, Oxford University Press, American Branch, 1927. ISIS

We have already spoken (see *Isis*, 6, 138; 7, 532) of this English translation of ARISTOTLE, to be completed in eleven volumes, corresponding in content and pagination with the BEKKER's 8vo Oxford edition; Vol. VII contains the Problemata. Says the translator : « The inclusion of the Problemata in the Aristotelian Corpus is no doubt due to the fact that Aristotle is known to have written a work of this kind, to which reference is made in his genuine works and by other writers. An examination of these references shows that some of them can be connected with passages in the Problemata, while others cannot; from which it may be concluded that, while the Problemata is not the genuine Aristotelian work, it nevertheless contains an element derived from such a work. It is also obviously indebted to other Aristotelian treatises, especially those on Natural History, to the Hippocratean writings, and to THEOPHRASTUS. The repetitions and contradictions which occur in the work seem to show it was a gradual compilation by several hands; and, if one may judge from the late forms of words which occur in several passages, it did not reach its final form until some time after the beginning of the Christian Era. Some critics would date its completion as late as the fifth or sixth century A. D. The doctrine throughout is Peripatetic, and the variety of subjects treated shows the wide interests of that school. The text used for this translation is that of Ruelle-Knoellinger-Klek (Leipzig, Teubner, 1922) » There

is an excellent index which is especially useful for a miscellaneous collection of this kind. G. S.

Arnim, Hans von. Die drei aristotelischen Ethiken. 142 p. *Wiener Akademie, Phil. Kl. Sitzungsber.*, 202, 2, 1924. ISIS

Reviewed by J. L. STOCKS in *Deutsche Literaturzeitung*, 1054-1059, 1927.

Arnim, Hans von. Zur Entstehungsgeschichte der aristotelischen Politik. *Akad. d. Wiss. in Wien, Philos-histor. Kl., Sitzungsber.*, 202, 1. 130 p. Wien, Hölder-Pichler-Tempsky, 1924. ISIS

Reviewed by J. L. STOCKS in *Deutsche Literaturzeitung*, 1054-1059, 1927.

Atanassiévitch, Xénia. L'atomisme d'EPICURE. 111 p. Paris, Les Presses universitaires de France, 1927. ISIS

Haberling, Wilhelm. Der glatte Hai des ARISTOTELES. Briefe JOHANNES MÜLLERS über seine Wiederauffindung an WILHELM KARL HARTWIG PETERS 1839-1840. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 166-184, 5 Abb., 1927. SIS

Joachim, Harold H. ARISTOTLE'S Conception of Chemical Combination. *The Journal of Philology*, 29, 71-86, 1903. ISIS

A very valuable study of ARISTOTLE's conception of *κρᾶσις* or *μῖξις*. ARISTOTLE recognizes the distinction between mechanical mixture and chemical combination. The proper term for the first is *σύνθεσις*, though sometimes it is popularly called *μῖξις*. The proper term for chemical combination in general is *μῖξις* : for chemical combination of liquids the strict term is *κρᾶσις*. If two or more bodies are put together without alteration, this is a *σύνθεσις*, and the resultant is a mechanical mixture. A *μιχθέν*, or chemical compound, is such that (1) its components have really merged into a unity, instead of forming a mere aggregate by juxtaposition : and that (2) the components although contained in the resultant, are contained there in an altered form. The facts are drawn mainly from *de generatione et corruptione* and ZABARELLA and ALEXANDER's works. (ALEXANDER, *Περὶ κράσεως καὶ αὐξήσεως* ed. BRUNS, and ZABARELLA, *de mistione*, ch. 13, etc., Cologne edition of 1594.) E. J. H.

(Kauṭilya). *Introduction I*, 147. Die Arthaśâstra ist vielfach, und bis in späte Zeit hinein, interpoliert. E. O. v. L. ISIS

Steensby, Hans Peder. PYTHEAS fra Massilia og Jyllands Vestkyst. *Geografisk Tidsskrift*, Bind 24, 1917. J. W. S. J. ISIS

(Theophrastos). *Introduction I*, 186. Wasserbad (bain Marie) wird schon bei THEOPHRASTOS als bekannt erwähnt. E. O. v. L. ISIS

Wright, Jonathan. The evolution of the thought of ARISTOTLE. I. The

Platonic SOCRATES and the Platonic ARISTOTLE. *Annals of Medical History*, 9, 144-168, 1927. ISIS

IIIrd Century B. C. (whole and first half).

Fladt, Kuno. EUKLID. VIII+72 p., 10 fig. Berlin, OTTO SALLE, 1927. ISIS

Heath, Sir Thomas L. The thirteen books of EUCLID's Elements. Translated from the text of HEIBERG, with introduction and commentary. Second edition. 3 vols. Cambridge, University Press, 1926. ISIS

Reviewed by HEINRICH WIELEITNER in *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 238-240, 1297; and by GEORGE A. GIBSON, *Nature*, 119, 152-3, 1927. The first edition appeared in 1908.

(Museum). *Introduction I*, 158, 466. Bibliotheken Alexandria's dürfen grössentheils schon bei der Belagerung durch J. CAESAR zerstört worden sein. E. O. v. L. ISIS

(Proverbs of Solomon). *Introduction I*, 163. Sprüchwörter SALOMO's stammen zum grossen Teil aus altägyptischen Quellen. E. O. v. L. ISIS

Samaritan Pentateuch (*Introduction I*, 151). Concerning the Samaritans there is a good article in *Bibliotheca Sacra* (St. Louis), Jan. 1921, 1-22, and recent publications by MOSES GASTER: The Samaritans (Oxford press, 1925); Encyclopaedia of Islam (vol. 4, 124-29, 1925, and supplement of 15 p., 1925). He thinks it much older than most scholars do. H. G. BÉVENOT. ISIS

IIIrd Century B. C. (second half).

Czwalina, Arthur. Berechnung von Quadratwurzeln bei den Griechen *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 334-335, 1 Abb., 1927. ISIS

Apropos of ARCHIMEDES's approximate value of the square root of three. G. S.

Kliem, Fritz, und Wolff, Georg. ARCHIMEDES. VIII + 143 p., 64 fig., 3 pl. Berlin, OTTO SALLE, 1927. ISIS

Kliem, Fritz. APPOLLONIUS. 75 p., 39 fig. Berlin, OTTO SALLE, 1927. (Mk. 2.40). ISIS

This little book is divided as follows: 1. APOLLONIUS' Leben und Schriften; 2. Die Berührungsaufgabe; 3. Die Kegelschnitte. It contains a clear analysis

of the eight books of APOLLONIOS's Conics, in modern language. It will enable the reader to obtain with comparative ease a good appreciation of the method and contents of this great work. G. S.

Paoli, Humberto J. M. « Spamnites » (sic) di ARCHIMEDES da Surakusai, con appendici di HEARTH (sic) e CHASLES. 92 p., 32 fig., casa edit. « Coni », Buenos Aires, 1925. ISIS

Cette traduction espagnole de l'Arénaire (ψαμμίτης) se présente fort mal, avec les trois fautes d'orthographe que présente son titre [le ψ transformé en sp., (la faute est cependant corrigée à la main sur l'exemplaire que j'ai reçu), le μμ en mn, et le nom de T. L. HEATH modifié en Hearth]. Page 5, un portrait ? d'ARCHIMÈDE, avec cette indication « nato il 212 a. C., morto il 137), où l'âge d'ARCHIMÈDE est bien respecté, mais l'année de sa mort étant prise pour celle de sa naissance, et 137 n'ayant aucun rapport avec le géomètre de Syracuse; à la même page 5, on cite Hultse pour HULTSCH, Kyöbenhavn est imprimé comme un nom d'homme; p. 6 « il papiro fu trovato dall'HEIBERG nel 1917 », il s'agit du palimpseste découvert à Jérusalem en 1899, déchiffré en 1906 par J. L. HEIBERG, et traduit en allemand, avec commentaire de H. G. ZEUTHEN en 1907 ! etc... Comme celle de VER EECKE (*Isis*, 4, 499-501), la traduction est littérale, mais partagée en chapitres avec titres, sous titres, numéros de paragraphes. Nombreuses notes donnant un commentaire en notations modernes : on les dirait presque reprises de l'édition de VER EECKE. L. G.

IInd Century B. C. (whole and first half).

Wunderer, Carl (d. 1926). POLYBIOS : Lebens- und Weltanschauung aus dem zweiten vorschristlichen Jahrhundert. (*Das Erbe der Alten*, Heft, 12). VIII + 79 p., pl. Leipzig, DIETERICH, 1927. ISIS

Reviewed by JACOB HAMMER, *American Historical Review*, 33, 171-2, 1927.

Ist Century B. C. (whole and first half).

Cleomedes. Die Kreisbewegung der Gestirne. Übersetzt und erläutert von ARTHUR CZWALINA. (*Ostwalds Klassiker*, 220). IV + 93 p. Leipzig, Akademische Verlagsgesellschaft, 1927. ISIS

(Lucretius). *Introduction I*, 205. Es fehlt die beste Ausgabe und Übersetzung, von DIELS (Berlin, 1922, 23). E. O. v. L. ISIS

(Theodosius Tripolites). Sphaerica. Edidit J. L. HEIBERG. (*Abhandlungen der Gesellschaft der Wissenschaften zu Göttingen. Philologisch-historische Klasse*, neue Folge, Bd. 19, 3). XIV + 199 p. Berlin, WEIDMANN, 1927. ISIS

In my note on THEODOSIOS of Bithynia (*Introduction*, vol. I, 211) I stated that a critical edition of his works was very much needed. I did not realize when writing this that my wish would be so promptly satisfied. For here

we have a critical edition of THEODOSIOS's main work, the Spherics, by one of the leading scholars on the subject. The Greek text is accompanied by a Latin translation and followed by Greek scholia. No glossary. G. S.

Ist Century B. C. (second half).

Mondolfo, Rodolfo. La formazione storica delle arti e dello spirito umano in VITRUVIO. *l'Arduo*, 2, 153-9, 1922. ISIS

Ist Century (whole and first half).

(Celsus). *Introduction I*, 240. Er übersetzte das Buch des kaiserlichen Hofarztes MENEKRATES (WELLMANN). E. O. v. L. ISIS

Couchoud, Paul Louis. Les textes relatifs à JÉSUS dans la version slave de JOSÈPHE. *R. de l'hist. des religions*, 93, 44-64, 1926. ISIS

Publication et commentaires de huit passages concernant JEAN-BAPTISTE et JÉSUS, qui se trouvent dans la traduction en vieux russe de la Guerre des Juifs, de FLAVIUS JOSÈPHE, et qui ne figurent pas dans le texte grec de cet ouvrage. Ces passages sont traduits d'après A. BERENDS (1906) qui suit principalement le Codex 651 de l'Académie de Moscou. Pour l'auteur, ces textes ne peuvent être attribués à JOSÈPHE. L. G.

(Democritos, pseudo). *Introduction I*, 239. Die « syrischen Texte » sind höchst verdächtig und aus später Zeit. E. O. v. L. ISIS

Eisler, Robert. JÉSUS d'après la version slave de FLAVIUS JOSEPHE. *R. de l'hist. des religions*, 93, 1-21, 1926. ISIS

Voir ci-dessus la notice relative au travail de P. L. COUCHOUD. Contrairement à COUCHOUD, EISLER invoque en faveur des fragments slaves de JOSÈPHE la lumière dont ils seraient susceptibles d'éclairer certains textes évangéliques. L. G.

Gardner-Smith, Percival. The narratives of the resurrection; a critical study. XXVII + 196 p. London, METHUEN, 1926. ISIS

Goguel, Maurice. Le témoignage de la version slave de la « Guerre juive » de JOSÈPHE sur la mort et la résurrection de Jésus. *R. de l'hist. des religions*, 93, 22-43, 1926. ISIS

Voir ci-dessus : COUCHOUD, EISLER. « Il n'est pas possible, dit GOGUEL, que les fragments propres à la version slave de la guerre juive puissent jeter quelque lumière nouvelle sur les textes évangéliques et aider à les interpréter. » Bibliographie. L. G.

K., W. Glass figure of a whale from Greece. *The British Museum Quarterly*, 1, 104-106, 1 pl., 1927. ISIS

Curious figure of blown glass measuring 7 inches and representing imperfectly a bottle-nosed whale; according to a note contributed by Sir SIDNEY

HARMER, the *Ziphius cavirostris* described by CUVIER in 1823. « It may be ascribed to the first century » of our era. G. S.

Ist Century (second half).

(**Dioscorides**). *Introduction I*, 259. *περὶ ἁπλῶν φαρμάκων* ist nicht apokryph, s. Zeile 34. Das berühmte Manuscript ist in Wien. E.O.v.L. ISIS

Fischer, Isidor. Die Gynäkologie bei DIOSKURIDES und PLINIUS. 36 p. Wien, SPRINGER, 1927. ISIS

Henderson, Bernard William. Five Roman emperors, A. D. 69 — 117. Cambridge, University Press, 1927. ISIS

McNeile, Alan Hugh. An introduction to the study of the New Testament. Oxford, University Press, 1927. ISIS

Mothersole, Jessie. AGRICOLA's road into Scotland : the great Roman road from York to the Tweed. With illustrations in colour and black and white by the author. Plates, plans, maps and diagrams. London, JOHN LANE, 1927. ISIS

(**Nero**). *Introduction I*, 247. NERO's « Smaragd » war keine Linse, sondern ein grünes Glas zum Schutze seiner schwachen Augen; auch eine grüne Arznei heisst « smaragdinus ». E. O. v. L. ISIS

Scott, Charles A. Anderson. Christianity according to ST. PAUL. XIV + 284 p. Cambridge, University Press, 1927. ISIS

« It is a strange fate indeed which has befallen the Apostle PAUL in the last quarter of a century. For four centuries at least he has been looked on as the champion of an Evangelical interpretation of Christianity, his writings as the sheet-anchor of Protestantism. Now there is an influential school of thought both at home and abroad which claims him as the author of « sacramentarian » Christianity and the only begetter of Catholicism.

This book has been written with the issue thus raised in view, but with the conviction that the best way of dealing with it is to set forth as fully as may be within the necessary limitations of space what chiefly matters in St PAUL's conception of Christianity. Some of the results, which have been slowly arrived at through many years of study of the Apostle, are not likely to please partisans either of traditional Protestantism or of traditional Catholicism. »

IInd Century (whole and first half).

Czwalina, Arthur. Die Trigonometrie des PTOLEMÄUS von Alexandria. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 241-249, 1927. ISIS

Luckey, P. Das Analemma von PTOLEMÄUS. *Astron. Nachr.* 230, 18-46, 1927, mit 1 Tfl. ISIS

Die Vermutung dass die mittelalterlichen Verfahren, die bei dem Gebrauch der Astrolabien üblich waren, auf das Altertum zurückgehen müssten, führte den Verf. auf das (leider nur in lat. Übersetzung erhaltene) Analemma des PTOLEMAIOS, das zwar schon von verschiedenen Männern und von verschiedenen Gesichtspunkten aus studiert worden war, über das eine alle Gesichtspunkte berücksichtigende, in den Sinn des Ganzen eindrigende Untersuchung aber immer noch fehlte. Die vorliegende Arbeit füllt diese Lücke in jeder Hinsicht völlig aus. Der Verfasser bespricht nacheinander das Analemma als das graphische, das rechnerische und das nomographische Verfahren, das in ihm steckt. Dabei ist freilich das Rechnerische nur angedeutet, da die Ausführung für PTOLEMAIOS zu umständlich gewesen wäre. Auch darf man nicht glauben, dass etwa das Analemma ein modernes Nomogramm sei. Doch hat der Verf. durchaus recht, wenn er sagt, dass wir das alte Verfahren, ohne etwas hineinzulesen, als im Wesen mit den modernen Gesichtspunkten übereinstimmend betrachten dürfen. Die Untersuchung hat als Nebenresultat ergeben, dass PTOLEMAIOS in der Fassung der Begriffe und in der Verwendung der Methoden über seine Vorgänger hinaus wesentliche Fortschritte machte, und dass er sich der Verbesserungen, die er einführte wohl bewuszt war. Auch in terminologischer Beziehung bringt die Arbeit LUCKEYS manches Neue. H. W.

Malone, Kemp. PTOLEMY's Skandia. *American Journal of Philology*, p. 362-370, 1924. ISIS

Renou, Louis. La géographie de PTOLÉMÉE. L'inde (VII, 1-4). *Thèse de doctorat*, 73 p., 6 cartes. Paris, CHAMPION, 1925. ISIS

Édition critique du texte et traduction française. Reproduction en facsimilé des trois cartes grecques du Venetus 516 (R) : Inde cisgangétique, Inde transgangétique, Taprobane, et transcription latine de ces cartes.

(Soranos). SORANI Gynaeciorum libri IV, De signis fracturarum, De fascis, Vita HIPPOCRATIS secundum SORANUM, edidit JOANNES ILBERG. Adnexae sunt tabulae XVIII. (*Corpus medicorum graecorum*, IV). XXII + 282 p., 18 pl. Leipzig, TEUBNER, 1927. ISIS

The eighteen plates contain a large number of illustrations derived from the Codex Laurentianus LXXIV. 7. Very copious indices (nominum; verborum), p. 185-282. G. S.

(Theon of Smyrna). *Introduction* I, 272. Magische Quadrate waren in Vorderasien schon lange bekannt. E. O. v. L. ISIS

IInd Century (second half).

(Aretaeos). *Introduction I*, 307. Diabetes ist bei ihm Polyurie, nicht Zuckerkrankheit. E. O. v. L. ISIS

(Pausanias). *Introduction I*, 300. PAUSANIAS hat schwerlich selbst alles

bereist sondern Vieles aus älteren Büchern abgeschrieben. E.O.v.L. ISIS

IIIrd Century (whole and first half).

(**Alexander of Aphrodisias**). *Introduction I*, 319. Er weiss *nichts* über die wirkliche Destillation. E. O. v. L. ISIS

Miura-Stange, Anna. CELSUS und ORIGENES, das Gemeinsame ihrer Weltanschauung nach den acht Büchern des ORIGENES gegen CELSUS. VII + 166 p. Giessen, ALFRED TÖPELMANN, 1926. ISIS

Reviewed by U. v. WILAMOWITZ-MOELLENDORFF, *Deutsche Literaturzeitung*, 103-105, 1927.

Müller, Reiner. Die Geographie der Peutingerschen Tafel in der Rheinprovinz, in Holland und Belgien. S. A. aus *Geographischer Anzeiger*, 1926, 8 p. ISIS

(**Silk trade routes**). *Introduction I*, 315. Es fehlen HERRMANN's massgebende Arbeiten über Seidenstrassen etc. E. O. v. L. ISIS

IIIrd Century (second half).

(**Caelius**). *Introduction I*, 340. Wir besitzen nur einen Auszug, etwa aus dem 5. Jahrhundert n. Chr. E. O. v. L. ISIS

Caley, Earle Radcliffe. The Stockholm papyrus. An English translation with brief notes. *Journal of Chemical Education*, 4, 979-1002, 1927. ISIS

The first translation in English, based upon the Greek text and the German translation of LAGERCRANTZ. The Leiden papyrus X deals largely with metals, the Stockholm papyrus largely with the arts of dyeing, imitating precious stones, etc.; together they constitute our most valuable source of knowledge about the chemical arts of (probably) the latter part of the third century. Recipe No. 74 gives intelligible and practical directions for the preparation of verdigris. T. L. D.

Czwalina, Arthur. Ein falscher Satz des PAPPOS. *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 233-4, 1927. ISIS

Rome, (abbé) **A**. L'astrolabe et le météoroscope d'après le commentaire de PAPPUS sur le 5e livre de l'Almageste. *Annales de la Société scientifique de Bruxelles, Série A. Sciences mathématiques*, 47, 77-102, 1 fig., 1927. ISIS

« Nous avons déjà parlé des cercles équatoriaux d'après THÉON, au 3e livre de son commentaire sur l'Almageste. En faisant subir sa dernière toilette

au 5e livre de PAPPUS, nous avons rencontré des renseignements sur l'appareil le plus compliqué de l'observatoire antique : le météoroscope, et son frère un peu simplifié, l'astrolabe. » L'astrolabe dont il s'agit ici n'est pas l'astrolabe plan, mais l' « astrolabon organon », un groupe de sept anneaux (ou armilles) concentriques articulés l'un sur l'autre. G. S.

(**Zosimos**). *Introduction I*, 339. Dis Schrift über Bier ist eine Fälschung. E. O. v. L. ISIS

IVth Century (whole and first half).

Burch, Vacher. Myth and CONSTANTINE THE GREAT. VIII + 321 p. Oxford, University Press, 1927. ISIS

« A fresh examination of the legends which have gathered about CONSTANTINE has led to the discovery of a primal *Vita Constantini* as their source. This document was an early Romano-Sabine product. It displaces the Near East as the creator of the tales which gave the Constantine-Silvester literature such vogue in the Middle Age. »

(**Eusebios**). The Ecclesiastical History and the Martyrs of Palestine. Translated with introduction and notes by HUGH JACKSON LAWLOR, and JOHN EARNEST LEONARD OULTON. Vol. 1 : translation. XVI + 402 p. London, S. P. C. K., 1927. ISIS

IVth Century (second half).

Feldhaus, Franz M. Technisches in den Dichtungen des CLAUDIUS CLAUDIANUS. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 151, 1927. ISIS

Monceaux, Paul. SAINT MARTIN, Récits de SULPICE-SÉVÈRE mis en français avec une introduction. 242 p. Paris, PAYOT, 1926. ISIS

Plater, William Edward and **White, H. J.** A grammar of the Vulgate. Oxford, Clarendon Press, 1926. ISIS

Vth Century (whole and first half).

Monneret de Villard, Ugo. Les couvents près de Sohâg (Deyr el-Abiad et Deyr el-Ahmar). Ouvrage publié sous les auspices du Comité de Conservation des Monuments de l'Art Arabe. 2 vols., 222 pl. Milan, 1926. ISIS

Reviewed by A. KINGSLEY PORTER, *Speculum*, 2, 356-359, 1927.

(**Olympiodoros**). *Introduction I*, 389. Der Alchemist und der Historiker sind nicht identisch. E. O. v. L. ISIS

Tanfani, Gustavo. La rieducazione dei movimenti nelle paralisi

secondo Celio Aureliano. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle Scienze mediche e naturali (Venezia, 1925) Siena, p. 216-221, 1926. ISIS

Vth Century (second half).

Datta, Bibhutibhushan. « Âryabhata, the author of the « Ganita » *Bulletin of the Calcutta Mathematical Society*, 18, 5-18, 1927. ISIS

The author of the « Ganita » is that Âryabhata who was born in 476 and not a writer of the tenth century as Kaye has argued (« Notes on Indian mathematics, no. 2 — Âryabhata », *Journal Asiat. Soc. Beng.*, p. 111, 1908; « The two Âryabhatas », *Bibl. Mathematica*, 10, 289-292, 1910). R. C. A.

Gânguli, Sâradâkânta. The elder Âryabhata and the modern arithmetical notation. *American Mathematical Monthly*, 34, 409-15, 1927. ISIS

Burnell asked « May not Âryabhata be the discoverer of the decimal notation in India ? » The author answers yes. « Both Âryabhata and Brahmagupta have omitted the easier topics from the chapters of their works dealing with mathematics. But while the enunciation of the modern arithmetical notation finds a place in the elder Âryabhata's work, Brahmagupta considers it too common-place for inclusion in his work. Âryabhata would have certainly omitted it on account of its simplicity if it were popular when the Âryabhatîyam was written or if it had occurred in a previous work. This leads us to conclude that the Âryabhatîyam is the first work in which the modern arithmetical notation has been explained. »

VIth Century (whole and first half).

Bereschit rabba, mit kritischem Apparat u. Kommentar von J. Theodor. Nach dem Ableben des Verfassers bearbeitet und ergänzt von Ch. Albeck. Lief. 10-12, pp. 721-960. (*Veröffentl. d. Akad. für die Wissenschaft des Judentums*). Berlin, Poppelauer, 1926. ISIS

Reviewed by S. Landauer in *Deutsche Literaturzeitung*, 1197-1198, 1927.

Herwegen, Ildefons. (Abt von Maria Laach). Der heilige Benedikt. Ein Charakterbild. 3 Aufl. IX + 165 p. Düsselforf, L. Schwann, 1926. ISIS

Reviewed by Joseph Lortz in *Deutsche Literaturzeitung*, 1145-54, 1927

Schleifer, J. Zum Syrischen Medizinbuch. *Zeits. f. Semitistik und verwandte Gebiete*, 4, 70-122, 161-195, 1926. ISIS

Brockelmann pointed out that the Syriac medical treatise edited by Wallis Budge was largely, in its general sections on pathology and therapeutics, taken from Galen's *περὶ τῶν πεπονθότων τόπων*. The present author has found a further series of borrowings from Galen, beyond those noticed

by BROCKELMANN. A suspicion was awakened that the rest of the general portion of the work might owe its origin to Greek writings, perhaps to other works of GALEN. This has proved to be the case; almost the whole of the general pathological-therapeutic portion is taken from various works of GALEN; these are enumerated, the several passages being equated with the parallel passages of the Syriac. The author has subjected BUDGE's translation to a revision, and the greater part of the present communications consist of suggested improvements in translation, of a number of emendations of the Syriac text based on a comparison of the Greek from which it was taken, and of explanations of the text. See SARTON's *Introduction*, vol. I, 310. J. S.

Tuffau, Paul. Le merveilleux voyage de SAINT BRANDAN à la recherche du Paradis. Légende latine du IX^e^ siècle renouvelée. 198 p. Paris, L'artisan du Livre, 1925. ISIS

A graceful literary development of the *Peregrinatio Sancti Brandani*, which offers some archaeological interest because it deals with one of those mythical Atlantic islands which have so much engrossed the minds of seafaring people not only during the Middle Ages but almost until modern times. (See WILLIAM H. BABCOCK : Legendary islands of the Atlantic, New York 1922; *Isis*, 5, 167-70). Some elements of the legend suggest comparison with the Arabian Nights, e.g. the moving island, which is the largest of all fishes, named Jasconius, and the gigantic bird which makes one think of Rukhkh ! BRANDAN (Brendan, Brenain) of Clonfert was an Irish saint (born in 484, died in 577). See Dictionary of national biography (vol. 6, 259) and Potthast (1896, 1221). G. S.

VIth Century (second half).

Gregory of Tours (538-594). History of the Franks. Translated with an introduction by ORMONDE MADDOCK DALTON. Two volumes. Oxford, Clarendon Press, 1927. ISIS

VIIth Century (whole and first half).

Buhl, F. The Koran. Encyclopaedia of Islam, vol. 2, 1063-1076, 1927. ISIS

Moreau, Edouard de (S. J.). SAINT AMAND. Apôtre de la Belgique et du Nord de la France. (Museum Lessianum. Éditions et publicat. dirigées par des Pères de la Comp. de Jésus.) x + 367 p. Louvain, Museum Lessianum, 1927. ISIS

Reviewed by HÉLÈNE WIERUSZOWSKI, *Deutsche Literaturzeitung*, 1846-48, 1927.

(Stephanos). *Introduction I*, 473. Sein Buch ist *nicht* apokryph. E. O. v. L. ISIS

Temple, Sir R. C. To the East of Samatata (S. E. Bengal). *Indian Antiquary*, 55, 113-15, 1926. ISIS

Towards an identification of the countries mentioned (but not visited) by the Chinese traveller HSÜAN TSANG. J. S.

VIIth Century (second half).

(**Callinicos**). *Introduction I*, 494. Salpeter war damals noch unbekannt, vollends für Sprengstoffe und dergleichen. E. O. v. L. ISIS

(**Khâlid ibn Yazîd**). *Introduction I*, 489, 495. Die Angaben über KHÂLID sind ganz unhaltbar. E. O. v. L, ISIS

VIIIth Century (whole and first half).

Colgrave, Bertram. The life of Bishop WILFRID by EDDIUS STEPHANUS. Latin text, translation, and notes. XVII + 192 p. Cambridge, University Press, 1927. ISIS

« EDDIUS's Life of WILFRID (634-709) is, with the exception of the Anonymous Life of St CUTHBERT, and BEDE's Metrical Life of the same saint, the earliest piece of biography we possess. In fact it is almost the earliest considerable piece of literature written in this country. Its importance is obvious for it gives us a contemporary picture of a man who was a great figure in the political and ecclesiastical life of the seventh century. The Church was definitely moulded into shape during WILFRID's lifetime, and WILFRID himself played a leading part in deciding what that shape should be. He was largely instrumental in converting the whole of Northumbria to the Roman form of Christianity; he brought the north definitely into contact with the Mother Church by his journeys to Rome and by his appeals to the Apostolic See; he built churches which were the wonder of the western world; he exercised a great influence on the art and architecture of the times, and, more important even than all these, by his defiance of kings and princes he asserted the authority of the Church in so definite a manner that as a result no less than twenty six of the forty-six years of his episcopacy were spent in exile. He died worn out by the struggle, but he had triumphantly proved that the Church was no mere appendage to the throne. »

(**Heliodoros**). *Introduction I*, 514. THEODOSIOS III. hielt schon KOPP für möglich. E. O. v. L. ISIS

VIIIth Century (second half).

(**Compositiones ad tingenda**). *Introduction I*, 533. Ein bronzener Mörser, bronzinus, wird schon um 700 im « Fragment von Ivrea » erwähnt; von Vitriol sagt schon PLINIUS, er setze sich wie ein blaues Glas an ; vergleiche das italienische « vetraviolo ». E. O. v. L. ISIS

(**Jâbir ibn Haiyân**). *Introduction I*, 532. S-Hg-Theorie ist schon alexandrinischen Ursprungs. E. O. v. L. ISIS

(**Mappae clavicula**). *Introduction I*, 534. Alkohol : die Angaben von DIELS und DEGERING sind völlig unhaltbar. E. O. v. L. ISIS

Simonini, R. Sopra un « Antidotarium Theodoron » contenuto in un Codice dell' VIII-IX secolo, conservato nell' Archivio Capitolare di Modena. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 188-93, 1926. ISIS

Simonini, R. Sopra un codice dell' VIII secolo conservato nell'Archivio della Metropolitana di Modena e contenente APULEJ Liber De Ablatione simplicium (Communicazione preventiva). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 178-187, 1026. ISIS

IXth Century (whole and first half).

Lowe, Lawrence F. H. and **Edwards, Bateman.** The language of the Strassburg oaths. *Speculum* 2, 310-317, 1927. ISIS

(**Muslim mineralogy**). *Introduction I*, 572. Das Steinbuch des ARISTOTELES ist nicht mit dem syrischen Buch von AHRENS identisch. E. O. v. L. ISIS

Rifâ'î, Aḥmad Fârîd. 'Aṣr AL-MA'MÛN. (Time of AL-MA'MÛN) Vol. 1. large 8vo in Arabic. Cairo, Arabic Library Press, 1927. ISIS

A rather poor compilation. Chapter VIII : « scientific life in the time of AL-MA'MÛN » (pp. 375-398) is compiled from the works of SANTELLANA and GURGI ZAIDÂN (Ta'rîkh at-tamaddun al-islâmî) giving quotations from IBN AN-NADÎM, IBN AL-QIFTÎ, IBN ABÎ UṢAIBI'A mostly in the form of anecdotic tales without order and plan. The list of translations is very incomplete. No references to the translations existing in libraries, not even those of Egypt. Chapter IX and X (literature and prominent scholars) have been examined by my friend Prof. Jos. SCHACHT of Freiburg and led him to the same judgment. M. M.

IXth Century (second half).

(**Dhû-l-Nûn**). *Introduction I*, 592. Die alchemistischen Schriften sind gefälscht. E. O. v. L. ISIS

(**al-Jâḥiẓ**). *Introduction I*, 579. Die Angabe über Salmiak ist fragwürdig (RUSKA). E. O. v. L. ISIS

Techert, Marguerite. Le plotinisme dans le système de JEAN SCOT ERIGÈNE. *Rev. néo-scolastique de philos.*, 27, 28-68, 1927. ISIS

Wiedemann, Eilhard. QOSṬA IBN LÛQÂ AL-BA'ALBAKKÎ. Encyclopaedia of Islam, Vol. 2, 1081-83, 1927. ISIS

Elaborate study with bibliography. G. S.

Xth Century (whole and first half).

Asín Palacios, Miguel. Abenmassarra y su escuela. Origenes de la filosofia Hispano-Musulmana (Discurso de ingreso en la Real Academia de Ciencias Morales y Politicas). Madrid, 1914. 167 pp. ISIS

IBN MASARRA of Cordova (883-931) was the founder of that Pseudo-Empedoclean or Illuministic philosophy which is best known through the works of another Spaniard, IBN 'ARABÎ (1165-1240). On the occasion of his admission into the Spanish Academy, ASÍN presented his fellow members with this very elaborate study, largely based upon the sources. He dealt successively with : 1) Muslim thought during the first three centuries; 2) Hispano-Muslim thought during the same period; 3) IBN MASARRA's life; 4) his pseudo-Empedoclean doctrine; 5) historical criticism of that doctrine; 6) his theological views; 7) his influence. Our only regret is that so thorough a study should have been left incomplete by the lack of an index. G. S.

(Ibn Waḥshîya). *Introduction I*, 634. Die alchemistischen Schriften sind Fälschungen. E. O. v. L. ISIS

XIth Century (whole and first half).

Asín Palacios, Miguel. ABENHÁZAM DE CÓRDOBA y su historia critica de las ideas religiosas. Tomo primero. 347 p. Madrid, Real Academia de la Historia, 1927. ISIS

This imposing volume is but a pedestal to a series of others which Don MIGUEL is preparing. It contains a very elaborate biography of IBN ḤAZM of Cordova, one of the greatest philosophers of Islam and of Spain (see my *Introduction*, vol. I, 713). Needless to say this biography is based upon all the oriental documents, many of which are available only in MS. form. Much information has been derived from IBN ḤAZM's own works. This volume will be followed by others containing a complete analysis and partial translation of IBN ḤAZM's main work, his critical history of religions. It will be remembered that Don MIGUEL had already translated another work of the same author, his treatise on ethics, in 1916. The present volume is a splendid continuation of the same great undertaking. It will help, I hope, to pull IBN ḤAZM out of the obscurity wherein he has been left, partly because of his own originality and non-conformity, almost until our days. As proof of this unjust neglect, it will suffice to say that SOLOMON MUNK, learned as he was, does not speak of him in his Mélanges de philosophie juive et arabe (1859). G. S.

Baer, Emil. Pratyabhijnâ-hridaya. Das Geheimnis des Wiedererkennens. Eine neuauflebende Heilslehre des indischen Mittelalters. Aus

dem Sanskrit übersetzt, eingeleitet und mit Anmerkungen versehen. *Dissertation*, Philos. Facult. I. IX + 111 p. Zürich, 1926. ISIS

Reviewed by R. F. G. MÜLLER in *Mitt. zur Geschichte der Med.*, 26, 203, 1927.

(**Firdawsî**). *Introduction I*, 705. Fehlt die ausgezeichnete Übersetzung von FR. RÜCKERT (Berlin 1890). E. O. v. L. ISIS

(**Mesuë Minor**). *Introduction I*, 699. Kein arabisches Original bekannt ! richtig S. 728. E. O. v. L. ISIS

(**Salerno**). *Introduction I*, 725. RENZI enthalt allerlei nicht wirklich Zugehöriges. E. O. v. L. ISIS

Saliba, Djémil. Étude sur la métaphysique d'AVICENNE, 215 p. Paris, *Thèse* pour le doctorat d'Université, 1926. ISIS

(**Tou P'ing**). *Introduction I*, 723. Destillation war damals in China noch unbekannt. E. O. v. L. ISIS

XIth Century (second half).

(**Adam of Bremen**). Hamburgische Kirchengeschichte. Nach der Ausgabe der Scriptores rerum Germanicarum in dritter Auflage unter Mitarbeit von BERNHARD SCHMEIDLER neubearbeitet von SIGFRID STEINBERG. Mit einer Karte. (*Geschichtschreiber der deutschen Vorzeit*, Band 44). XXXVII + 272 p. Leipzig, Dyk-sche Buchhandlg., 1926. ISIS

Asín Palacios, Miguel. Un compendio musulmán de pedagogía. 19 p. Zaragoza, E. BERDEJO CASAÑAL, 1924. ISIS

Analysis of AL-GHAZZÂLÎ's Kitâb fâtiḥat al'ulûm (Introduction to the sciences), of which an edition was printed in Cairo, 1322 (70 p., 1904). This work is of special interest because it is posterior to the Iḥyâ and may be considered an ultimate summary of the master's pedagogical views. The main idea is this : knowledge is not an end in itself, but a means; it is valuable to the extent that it increases our felicity in this life and the life to come. Thus his classification of the sciences is dominated by the final purpose, moral perfection; thence follow practical conclusions with regard to the duties of teachers and students. This is a very important contribution to the history of Muslim pedagogy. Of course it represents the very highest ideals of that pedagogy. Further information on this and cognate subjects may be found in PIERRE ARMINJON : L'enseignement, le doctrine et la vie dans les universités musulmanes d'Egypte (Paris, 1907) and GAËTAN DELPHIN : Fas, son université et l'enseignement supérieur musulman (Paris, 1889).

Bédier, Joseph. Commentaires sur la Chanson de Roland. Paris H. PIAZZA, 1927. ISIS

Reviewed by ROGER TISSERAND, *Larousse Mensuel*, 7, 455-456, Juillet 1927.

(Chanson de Roland). Das altfranzösische Rolandslied nach der Oxforder Handschrift. Hrsg. von ALFONS HILKA. (*Slg. Roman. Übungstexte*. Bd. 3-4). 135 p. Halle, M. NIEMEYER, 1926. ISIS

Reviewed by H. BREUER in *Deutsche Literaturzeitung*, 704-05, 1927.

(Compass). *Introduction I*, 764. Die chinesisiche Tradition, auch bei HIRTH, ist sehr unsicher. E. O. v. L. ISIS

Dalton, Ormonde Maddock. The Byzantine astrolabe at Brescia. *Proceedings of the British Academy*, 14 p., 3 pl. London, 1926. ISIS

Elaborate description of a large astrolabe in the Museo dell'Età Cristiana at Brescia. This monument is of great importance because the Greek inscriptions which it bears tell us that it was made for one SERGIOS THE PERSIAN, consul and protospatharios in 1062. It is wholly Byzantine : the names of the stars on the arachne are Greek, and they are all derived from the lists of PTOLEMY, not a single star bears a name of Arabic derivation; in the same way the numerals are Greek throughout. This suggests that Hellenistic astronomy continued to exist, however humbly, until the time of the Fourth Crusade, when Greek civilization received the coup de grâce. G. S.

Finkel, Joshua. An eleventh century source for the history of Jewish scientists in Mohammedan countries (IBN ṢÂ'ID). *Jewish Quarterly Review*, 18, 45-54, 1927. ISIS

Translation of the section of IBN SÂ'ID Ṭabaqât al-umam (see my *Introduction*, I, 776) dealing with Jews; with notes. G. S.

(Omar Khayyam) Rubâ'iyât. Edited by FRIEDRICH ROSEN, 68 + 329 + 47 p. Berlin, KAVIANI, 1304-1926. ISIS

Reviewed in *Revue des études islamiques*, 1, 19, 1927. Very important edition.

Rosen, Friedrich. Zur Frage der Vierzeiler OMAR's des Zeltmachers (Rubâ'îât-i-'UMAR-I-KHAYYÂM). *Zeits. d. Deut. Morgenl. Ges.*, n.F., 5, 285-313, 1926. ISIS

A study of the quatrains ascribed to OMAR. The author gives an account of previous work on the text of the Rubâ'iyât, and then describes an old MS. which has come into his hands, and which he has used for his recent edition (Berlin, 1925). The MS. is dated 721 (1321 A.D.), but the author considers this to be fallacious. J. S.

Ross, Sir E. Denison. OMAR KHAYYAM. *Bull. School Or. Studies*, vol. 4, pt. 3, 433-439, 1927. ISIS

A contribution towards the establishing of the text of the Rubaiyât. A unique MS. of date 741 (1340/41 A.D.), entitled Mu'nis ul Aḥrâr, and containing an anthology of Persian poetry, has recently come to light. In this OMAR is represented by 13 quatrains, only two of which are already known; the

remaining 11 are probably, from the date of the compilation, to be accounted genuine. J. S.

(Seth, Symeon). *Introduction I*, 771. MOSCHUS erwähnt schon der heilige HIERONYMUS. E. O. v. L. ISIS

Yetts, W. Percival. A Chinese treatise on architecture. *Bull. School Or Studies*, vol. 4, pt. 3, 473-492, 1927. ISIS

Innumerable written records indicate a continuity of architectural practice in China lasting more than 2000 years; foreign importation has affected Chinese architecture least of all the arts .But the literature is small, — indeed the book here treated of is the sole surviving work of importance. This is *Ying tsao fa shih*, — i.e., « Method of Architecture », composed in A.D. 1070 by the Inspector of the Board of Works at the order of the Emperor of the Northern Sung Dynasty. Practically all the MS. copies that survive, however, belong to a second edition of 1145 A.D. A photolithographed facsimile was published in 1920, and a printed edition in eight magnificent volumes, in 1925. The present article is a description of the contents (including an appendix by the editor) of the 1925 edition and the sources from which it has been compiled. J. S.

XIIth Century (whole and first half).

Crummer, Le Roy. COPHO's « Anatomia Porci ». *Annals of Medical History*, 9, 180-182, 1927. ISIS

Haskins, Charles Homer. An Italian master BERNARD. Essays in history presented to REGINALD LANE POOLE, p. 211-226, Oxford, 1927. ISIS

Apropos of an Italian dictator (i.e. a teacher of the art of letter-writing). G. S.

Levy, Raphael (1900-). The astrological works of ABRAHAM IBN EZRA. A literary and linguistic study with special reference to the old French translation of HAGIN. (The Johns Hopkins Studies in Romance literatures and languages, vol. 8). v + 173 p. Baltimore, Maryland, The Johns Hopkins Press, 1927. ISIS

The eight astrological treatises completed by IBN EZRA at Lucca in 1148 exerted a deep influence not only upon the Jews but also upon the Christians. Witness the many translations. The earliest of these was a French version by one HAGIN LE JUIF in 1273, in HENRY BATE's house, Malines. This French version was not written by him, but dictated to OBERT DE MONTDIDIER; this explains that it was written not in Hebrew but in Roman characters. HAGIN's version was the basis of many Latin translations : by HENRY BATE, 1281-92; by PETER OF ABANO, 1293 (this being the only complete one); by ARNOLD OF QUINQUEMPOIX, at the beginning of the fourteenth century. The Hebrew text was translated also in Catalan by MARTIN OF HUESCA, and one treatise of this Catalan version was translated into Latin in 1448 by LOUIS DE ANGULO.

LEVY's thesis is essentially devoted to a philological study of HAGIN's version.

It contains an elaborate glossary (p. 68-153), which is an important addition to French lexicography. About one hundred articles treat of words unknown in normal Old French texts and limited in use to Judaeo-French. The glossary is arranged « alphabetically and is destined to give, as a rule, 1° the form of the Old French word, 2° its definition in English, 3° its Latin translation, 4° the corresponding Hebrew term, 5° two references to passages where the word is used. » G. S.

Slover, Clark Harris. WILLIAM OF MALMESBURY and the Irish. *Speculum* 2, 268-283, 1927. ISIS

« 1) WILLIAM was interested in Irish material ; he had access to Irish documents ; and he was actively engaged in the adaptation of Irish material to the needs of Glastonbury Abbey. The Glastonbury advertisers, moreover, used Arthurian material. The work of WILLIAM, therefore, added to the Irish influence already established at Glastonbury and provided a means of contact between Arthurian romance and Irish tradition.

2) Contact between Irish tradition and English literature in general was further effected through WILLIAM's connection with the Norman court and with Arthurian literature in particular through his association with GEOFFREY OF MONMOUTH. »

Sudhoff Karl. Die erste Tieranatomie von Salerno und ein neuer salernitanischer Anatomietext. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 136-154, 1 Abb., 1927. ISIS

Discussion of the misnamed *Anatomia Cophonis* and of all available MSS., and edition of a critical text. This is followed by the edition of a new *Anathomia* by a pupil of MATTHAEUS PLATEARIUS — possible URSO OF CALABRIA (?), who died in 1225. This new text is included in a MS., sometime a part of the famous Library of AMPLONIUS RATINCK de Berka, c. 1412. The great majority of AMPLONIUS' books are now in the city library of Erfurt, but this particular MS. is in the possession of Graf SCHÖNBORN zu Pommerfelden (near Bamberg). G. S.

XIIth Century (second half).

Bliemetzrieder, Franz. Über literarische Vorlagen des Liber de naturis inferiorum et superiorum des DANIEL V. MORLEY. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 338-344, 1927. ISIS

Showing DANIEL's close dependence upon ADELARD OF BATH. His liber de naturis inferiorum et superiorum was composed between 1175 and 1200. G.S.

Marx, Alexander. The correspondence between the rabbis of southern France and MAIMONIDES about astrology. Hebrew Union College Annual, vol. III, p. 311-58, 1926. (Reprint of 52 p., plus 2 p. of errata, p. 53-54.) ISIS

This is a very valuable contribution to the study of mediaeval astrology.

The rabbis of southern France had written to MAIMONIDES, who was then living in Cairo, to find out his views on astrology. MAIMONIDES told them in his letter of 1194 that he had studied the subject, reading carefully every book available in Arabic; he had reached the conclusion that the whole science of astrology was baseless foolishness. He advises the Provençal rabbis to uproot this evil tree, cut off its branches, plant instead the tree of knowledge, gather its fruit and stretch forth their hands also to the tree of life. « In his systematic method he goes back to fundamentals and points out that everything a man is to believe must be traced to one of three categories : things which can be proved by mental processes like the teachings of arithmetic and geometry, things of which the five senses can convince us, and finally things known by tradition through the prophets and wise men. Only a foolish man would believe anything beyond these categories. » He claims that the belief in the astrological ideas is responsible for the downfall of Israel. This uncompromising attack upon the most popular superstition of his day increases considerably our admiration for MAIMONIDES. He was undoubtedly one of the very greatest men of his time, too great indeed, too much ahead of it, to be thoroughly understood. I do not believe for a moment, as MARX does, that the rabbis of France accepted MAIMONIDES's revolutionary conclusions. The fact that they continued to admire him does not prove in the least that they shared his views; it takes genius of the first order to shake off such deep rooted prejudices. We may confidently assume that the views expressed by one of them, the great rabbi ABRAHAM BEN DAVID of Posquières in favor of astrology were more representative of their real opinions or feelings on the subject. And we might expect the bolder minds to adopt, not MAIMONIDES's uncompromising condemnation, but a cautious halfway attitude, such as that of SOLOMON IBN ADRET, the famous rabbi of Barcelona (c. 1300). Only the very boldest could follow MAIMONIDES to the end. It is typical enough that MARX was not able to quote more than one Jewish writer, who fully indorsed MAIMONIDES's view, and that one, ISAAC BEN PULGAR, did not flourish until the first half of the fourteenth century, i.e. almost one and a half centuries later ! This memoir is followed (p. 37-52) by two original texts : 1) Letter of the Rabbis of southern France published from the unique manuscript of the Jewish Theological Seminary ; 2) MAIMONIDES' letter on astrology, A.D. 1194, published on the basis of manuscripts of the British Museum, the Jewish Theological Seminary and the Library of Munich. G. S.

Miller, Konrad. Mappae arabicae. VI. Band. IDRISI-Atlas, 336 photographische Wiedergaben aller bis jetzt bekannten geographischen Tafeln in den Manuskripten des IDRISI auf 80 (not 82) Lichtdruck-Tafeln. Selbstverlag des Herausgebers, Stuttgart, 1927. ISIS

A full review of the whole work appeared in *Isis* 9, 458-62. The present volume contains photographs of all the IDRĪSĪ maps available today in MS. These maps (or schemes, for many are far too schematic to be considered true maps) are taken mainly from six MSS. of the Book of ROGER and of the greater IDRĪSĪ map; two of these MSS. are in Oxford, the four others in Paris, Constantinople, Leningrad and Cairo. Photographs of the MSS. of the smaller IDRĪSĪ map are also reproduced, the reproductions being placed near the corresponding sections of the greater map. The three last plates (78 to 80) contain reproductions of the world map of AL-SFAXĪ (1592-1601) after a Paris MS.
G. S.

Vacarius. Liber pauperum. Edited for the Selden Society by F. DE ZULUETA. London, QUARITCH, 1927. ISIS

XIIIth Century (whole and first half)

Krumbhaar, E. B. The stigmata of ST. FRANCIS OF ASSISI. *Annals of Medical History*, 9, 111-119, illustrated, 1927. ISIS

Sudhoff, Karl. Der « Micrologus » Text der « Anatomia » RICHARDS DES ENGLÄNDERS. *Archiv für Geschichte der Medizin*, 19, 209-239, 1927. ISIS

« Dass zwischen dem Schriftwerk oder der literarischen Persönlichkeit des supponierten « RICARDUS SALERNITANUS » und des leibhaftigen « RICARDUS ANGLICUS » eine wirkliche Trennung nicht möglich sei, habe ich schon vor 5 Jahren ausgesprochen. Kurz nachher liess ich durch einen meiner Schüler (H. H. BEUSING, 1922) den Nachweis versuchen, dass es einen konstruierten medizinischen Autor « RICARDUS » in Salerno niemals gegeben habe und trat dann auch selbst mit meinem Namen hinter dies Untersuchungsergebnis, zugleich die ganze Persönlichkeit des « RICARDUS ANGLICUS », der auch « RICARDUS PARISIENSIS » genannt wird, mit einigen festen Strichen zu umreissen versuchend (*Janus*, 1924, 397-403). Dass damit das geistige Bild des Mannes noch nicht wirklich erschöpfend gewonnen ist, weiss niemand besser als ich. Vor allem harrt noch sein « Micrologus » der wirklichen literarischen Auferstehung, und als Vorarbeit zu einer solchen ist die ursprüngliche Textgestalt der anatomisch-physiologischen Beschreibung des Menschenkörpers edierend aus den Handschriften festzulegen, wie « RICHARD DER ENGLÄNDER », hochbetagt 1252 in London verstorben, sie in jungen Jahren zu Paris für diesen einführenden Abriss der gesamten Medizin ausgearbeitet hat, als « Anatomia ».

XIIIth Century (second half).

Bragman, Louis J. Some medical observations of MARCO POLO. *Medical Life*, 34, 313-315, 1927. ISIS

Chapman, Conrad. MICHEL PALÉOLOGUE, restaurateur de l'empire byzantin (1261-1282). *Thèse*. 204 p., 2 grav., 2 cartes. Paris, FIGUIÈRE, 1926. ISIS

Harris, Charles Reginald Schiller. DUNS SCOTUS. Two volumes. IX + 380 + 401 p. Oxford, Clarendon Press, 1927. ISIS

Johnsson, J. W. S. Zur Geschichte des rothaarigen Mannes, im Manuskript Ny k. S. 84b in der königlichen Bibliothek zu Kopenhagen. *Janus*, 31, 304-17, 1 pl., 1927. ISIS

« Wenn wir nun den Schluss aus unserer Untersuchung ziehen wollen, so ergibt sich, dass wir in Blatt 6 aus dem Manuskript Ny k. S. 84 b eine Aderlasstafel vor uns haben, die als Plakat in der Badstube eines Klosters

aufgehängt war. Der Text entstand mit Zuhilfenahme einer Handschrift der Ketham-Serie in den Jahren um 1400, wahrscheinlich unter dem Einfluss der grossen Badereform des Jahres 1370. »

Lippmann, Edmund O. von. Der persische Dichter SAADÎ über den Zucker (Aus der in Vorbereitung befindlichen Neuauflage der « Geschichte des Zuckers » : Abschnitt VI, Absatz 33.) *Die Deutsche Zuckerindustrie*, Berlin, Nr. 19; pp. 521-522, 1927. ISIS

Little, Andrew George. THOMAS DOCKING and his relations to ROGER BACON. Essays in history presented to REGINALD LANE POOLE, p. 301-331, Oxford, 1927. ISIS

THOMAS GOOD or THOMAS DOCKING (after his birthplace in Norfolk) was seventh lector to the Friars Minor at Oxford; he was still at Oxford in 1269; he wrote biblical commentaries of enormous length. He had some interest in physical science and derived some of his ideas from BACON. He was a lovable man but of no importance from our point of view. G. S.

Tällgren, O. J. Los nombres árabes de las estrellas y la transcripción alfonsina. Homenaje a MENÉNDEZ PIDAL, tome II, pp. 634-718. Madrid, 1925. ISIS

See additions and corrections in *Revista de fil. española*, 12, 400-01, 1925. The purpose of this study of the Alphonsine astronomy is primarily philological, phonetical. G. S.

Webb, Clement Charles Julian. ROGER BACON on ALPHONSE OF POITIERS. Essays in history presented to REGINALD LANE POOLE, p. 290-300, Oxford, 1927. ISIS

« The object of the following pages is to call attention to a curious notice by a contemporary writer of the medical treatment adopted in the case of ALPHONSE, Count of Poitiers and of Toulouse, the brother of ST. LOUIS, who is known to students of the history of France in the thirteenth century to have suffered from some kind of paralysis, and also from an affection of the eyes. The writer in question is no less celebrated a person than ROGER BACON, and his reference to the matter is to be found in his commentary on the pseudo-Aristotelian *Secretum Secretorum*. »

XIVth Century (whole and first half).

Asín Palacios, Miguel. La escatologia musulmana en « La Divina Comedia ». 103 pp. Madrid, Tipografia de la « Revista de Archivos, » 1924. ISIS

A critical study of the discussions which have been started by ASÍN's views on the Arabic sources of the Divine Comedy. (For a statement of these views, see *Isis*, 10, 65-8). This study appeared simultaneously in the following journals: *Il giornale Dantesco* (Firenze, vol. 26, 1923-24), in its original Spanish form; *Revue de littérature comparée* (Paris, 1924), abbreviated French version;

Litteris (Lund, 1924), abbreviated English version. It contains an alphabetical catalogue of all the critics, indicating where and when their reviews appeared and whether they were favorable or not, and to what extent. Then follow a history of the controversy, year by year (1919 to 1923), a classification of the objections, and the author's answers to them. I do not believe that any literary polemic has ever stirred the Republic of Letters as deeply as the one started by the learned professor of Madrid University. G. S.

Baudry, L. Fragments inconnus de G. D'OCCAM : le Tractatus de principiis theologiae .*C. R. Ac. Inscr. et Belles-lettres*, janv.-mars 1927, 46-55. ISIS

Le texte du *Tractatus de principiis theologiae*, attribué à GUILLAUME D'OCCAM par PIERRE DE CANDIE, était jusqu'à présent inconnu; BAUDRY croit l'avoir découvert dans le Ms latin 16130 de la Bibliothèque nationale (142 feuillets de la fin du XIV^e^ siècle). Mais, de l'étude de ce texte, il croit pouvoir conclure que le rédacteur de ce *Tractatus* n'est pas, malgré l'affirmation de P. DE CANDIE, GUILLAUME D'OCCAM, mais un personnage anonyme du milieu du XIV^e^ s. cherchant à s'assimiler sa doctrine et à en dégager les idées fondamentales. Par la même occasion, BAUDRY est amené à affirmer que le *De successivis* n'est pas non plus une œuvre authentique de GUILLAUME D'OCCAM, mais une compilation anonyme. L. G.

Gilbert, Allan H. DANTE's conception of justice. X + 244 p. Durham, N. C., Duke University Press, 1925. ISIS

Reviewed by KENNETH MCKENZIE, *Speculum* 2, 346-349, 1927.

Hochstetter, Erich. Studien zur Metaphysik und Erkenntnislehre WILHELMS VON OCKHAM. VIII + 179 p. Berlin, W. de Gruyter, 1927. ISIS

Irsay, Stephen d'. Defense reactions during the Black Death, 1348-1349. *Annals of Medical History*, 9, 169-179, 1927. ISIS

Longré, E. Questions inédites de MAÎTRE ECKHART, O. P., et de GONZALVE DE BALBOA, O. F. M. *Rev. néoscolastique de philo.*, 27, 69-85, 1927. ISIS

Publication d'un extrait du Ms 1071, de la bibliothèque municipale d'Avignon.

(Ockham, William of). The De imperatorum et pontificum potestate of WILLIAM OF OCKHAM. Edited by C. KENNETH BRAMPTON. XXXVIII + 108 p. Oxford, Clarendon Press, 1927. ISIS

Reviewed in *American Historical Review*, 33, 107-108, 1927.

Previté-Orton, Charles William. The authors cited in the Defensor Pacis (of MARSILIUS OF PADUA). Essays in history presented to REGINALD LANE POOLE, p. 405-420, Oxford, 1927. ISIS

XIVth Century (second half).

Cowley, Arthur Ernest. The Magna Chirurgia of GUY DE CHAULIAC. Essays in history presented to REGINALD LANE POOLE, p. 1-4, 1 pl., Oxford, 1927. ISIS

A propos of fragments found in the binding of MS. Hunt 175 of the Bodleian. These fragments contain part of a Portuguese translation of CHAULIAC's Magna chirurgia written in Hebrew characters. They were written, probably in Portugal, not later than 1450. G. S.

Emerton, Ephraim. Humanism and tyranny. Studies in the Italian Trecento. x + 377 p. Cambridge, Mass., Harvard University Press, 1925. (four dollars). ISIS

The bull *Unam sanctam* of BONIFACE VIII (1302) may be considered the most complete expression of the mediaeval ideal, the climax of « the greatest of Christian centuries », but it was promptly followed by the « crime of Anagni» (1303), which was the abrupt beginning of a new world. Feudal and clerical politics were gradually replaced by national and bourgeois ideals. So soon after its greatest triumph, the Church had to face one of its most terrible crises, one which was not healed until the Council of Constance more than a century later (1414-18). In fact, religious problems ceased from now on to occupy the center of the political stage. More and more importance was necessarily given to fiscal questions. « The history of the English Parliament, of the French Estates General, of the German Reichstag, the Spanish Cortes, and notably of the Italian republican institutions, is one long story of the transition of European society from an economy of barter to an economy of money and credit. »

The present book contains in English translation an interesting series of documents illustrating political thought in the second half of the fourteenth century. (1) COLUCCIO SALUTATI (1331-1406). Treatise on tyrants, written in 1400. SALUTATI was a Guelph and during his long administration of Florentine foreign policy, his main concern was to check Milanese imperialism. (2) BARTOLUS's treatise on tyranny, written probably towards the end of his life (1357). This is, as we would expect, more strictly juridical. (3) Biography of a typical tyrant of that time, the Ghibelline FRANCESCO DEI ORDELAFFI of Forlì, in Romagna. (4) Selections from the *Constitutiones Egidianæ*, the code promulgated by the Cardinal-legate EGIDIO ALBORNOZ at Fano in 1357. This code remained in vigor until 1816; it is one of the most interesting monuments of medieval legislation. (5) BARTOLUS's treatise on Guelphs and Ghibellines. (6). SALUTATI's letters in defense of liberal studies (i.e. Greek and Latin literature). For details, I must refer to the excellent prefaces. In one of them for example, the author gives a luminous account of Guelphism and Ghibellinism, by means of comparisons with the English and American « parties ». Taken by and large, Ghibelline meant Tory, Conservative, or Republican; Guelph, Whig, Liberal, or Democrat. The « Parte guelfa » of Florence has its most perfect counterpart in Tammany Hall !

These treatises on tyranny are of special interest today because the destinies of Italy are again in the hands of a tyrant. Now, as in the fourteenth century there can be no justification for such an evil, except the fear of a greater one, chaos and self-destruction. The most terrible aspect of the situation is that

it is apparently incurable, or at any rate, that it can not be cured without considerable pain and danger. No people has ever learned the use of freedom without it. MUSSOLINI's reign can not be more than an episode in the life of Italy, but what will happen next ? Admitting that he has saved Italy in a time of chaos, does this give him the right to jeopardize her future ? G. S.

Galbraith, Vivian Hunter. The Anonimalle Chronicle, 1333 to 1381. From a (French) MS. written at St. Mary's Abbey, York. Manchester, University Press, 1927. ISIS

Whitney, (Rev.) James Pounder. A note on the work of the Wyclif Society. Essays in history presented to REGINALD LANE POOLE, p. 98-114, Oxford, 1927. ISIS

XVth Century (whole and first half).

Battistini, Mario. GIOVANNI CHELLINI, medico di S. Miniato. *Riv. di storia d. sc. med. e natur.*, 18, 106-117, 1927. ISIS

GIOVANNI CHELLINI (1373 ? — 1462, 02, 04), riche médecin établi à Florence. L. G.

Lippmann, Edmund O. von. Ein Wunder bei der Harn-Beschauung. *Mitt. zur Geschichte der Medizin*, 26, 161, 1927. ISIS

Anecdote relative to fantastic uroscopy as related in the Mustaṭraf of MUḤAMMAD IBN AḤMAD AL-KHAṬÎB AL- ABSHÎHÎ (d.c. 1446). G. S.

Schevensteen, A. F. C. van. De hygiënische maatregelen van het magistraat van Antwerpen in de 15de eeuw. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 329-42, 1927. ISIS

XVth Century (second half).

Ballard, James F. Medical incunabula in the William Norton Bullard Collection. *Boston Medical and Surgical Journal*, 196, 865-875, May 26, 1927. ISIS

Birnbaum, Karl. Zur Psychiatrie des späten Mittelalters. *Deutsche medizinische Wochenschrift*, 1058-1059, 1927. ISIS

Hommel, Fritz. Zum Leben des HIERONYMUS BRUNSCHWYGK. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 155-157, 1927. ISIS

(Moyllus, Damianus). A newly discovered treatise on classic letter design. Printed at Parma by DAMIANUS MOYLLUS, circa 1480. Reproduced in facsimile. With an introduction by STANLEY MORISON. 82 p. Paris, The Sign of the Pegasus, 1927. ISIS

Polain, Louis. Marques des imprimeurs et libraires français du XVe siècle. T. 1. Des documents typographiques du XVe S. 120 p. Paris, E. DROZ, 1925. ISIS

C. R. de C. DALBANNE in *Rev. des bibliothèques*, 36e année, 342-8, 1926.

Schwäbl, Franz. Ein Wandgemälde in der Hohen Schule in Ingolstadt aus der Gründungszeit der Universität. Sammelblatt des Histor. Vereines Ingolstadt, S. 113 ff., 1926. ISIS

Sigerist, Heinrich E. Kritische Betrachtungen über die Frühgeschichte der Syphilis. *Deutsche Medizinische Wochenschrift*, Nr. 25, 1926. ISIS

SIGERIST has carefully examined the recent literature devoted to the origin of syphilis and found that nine tenths of it is scientifically worthless. The contributions of two authors seemed to him worth considering : (1) Prof. DOHI of Tokyo : Beiträge zur Geschichte der Syphilis insbes. über ihren Ursprung und ihre Pathologie in Ostasien (Tokyo, 1923). DOHI has examined early Chinese and Japanese works and found no trace of syphilis knowledge in them. He concludes that that disease did not exist in the Far East, until it was introduced by the Portuguese in Canton in 1505 and in Japan in 1512. Now Asia and Europe had been in touch since the time of ALEXANDER THE GREAT. Hence if syphilis had existed in Europe before COLUMBUS, it would have occurred also in the Far East. Ergo... But SIGERIST points out that it was not so much syphilis which was introduced by the Portuguese, as the knowledge of it.

(2). HILDEBRAND has studied various literary texts by ODO OF CLUNI (879-942), SEXTUS AMARCIUS (XIth cent.), GUILLAUME DE BLOIS (XIIth cent.) and SAINT HILDEGARD, and thinks they contain allusions to syphilis. This is very vague and altogether unconvincing.

I quote SIGERIST's final conclusion *verbatim* because of its wisdom : « Mir persönlich scheint die amerikanische Theorie die unwahrscheinlichere zu sein. Ich kann mir sehr gut denken, dass die Syphilis gegen Ende des Mittelalters in Europa tatsächlich, wenn auch unerkannt vorkam, dass man eines Tages in einem Zeitalter erhöhter Naturbeobachtung auch diese Krankheit von anderen unterscheiden lernte, dass diese Kenntnis wie ein Lauffeuer durch die Welt zog, dass man die neue Krankheit mit der neuen Welt in Zusammenhang brachte und an dieser Theorie festhielt, besonders da massgebende Wirtschaftskreise, die Guajakimporteure, an dieser Theorie interessiert waren. Die ganze Argumentenkette, die SUDHOFF und seine Anhänger aufgestellt haben, scheint mir aus historischen und medizinischen Gründen recht einleuchtend. Aber ich bin mir bewusst, dass es sich auch hier nur um eine Hypothese handelt, die nicht bewiesen werden kann, dass von irgendwelcher Sicherheit nicht die Rede sein kann, dass wir bereit sein müssen, diese Hypothese fallen zu lassen, falls sich die Gegengründe als wahrscheinlicher erweisen. »

We may believe many things about the origin of syphilis, but we *know* nothing, and it is probable that we shall never *know* anything with certainty.

G. S.

Sudhoff, Karl. Zur Lebensgeschichte BURKHARDS VON HORNECK

(gest. 1522). *Archiv für Geschichte der Medizin*, 19, 299-300, 1927. ISIS

Leonardo da Vinci.

Favaro, Giuseppe. Il peso del corpo umano negli studi di LEONARDO. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 162-176, 1926. ISIS

Marcolongo, Roberto. Le invenzioni di LEONARDO DA VINCI. P. 1a : Opere idrauliche, Aviazone. P. 2a : Arte militare, Meccanica pratica. *Scientia*, 41, 245-254, 393-402, 1927; trad. franç., supplém., 99-106, 159-167. ISIS

Indication rapide des sources où a pu puiser LÉONARD, et énumération de ses inventions. L, G.

Marcolongo, Roberto. La meccanica di LEONARDO DA VINCI. *Scientia*, 40, 277-286, 1926; trad. franç. id., suppl., 93-101. ISIS

« Procureremo di monstrare... quali fossero le conoscenze matematiche di LEONARDO; quale fosso lo stato della meccanica ai suoi tempi; quello che egli ha potuto apprendere dai suoi predesessori; quali sono stati il suo contributo e le sue scoperte. »

Scheer, Hermann. Die Einheit des Organischen im Werke LEONARDOS. Ansätze zu einer Deutung aus den anatomischen Blättern. *Archiv für Geschichte der Medizin*, 19, 318-330, 3 pl., 1927. ISIS

XVIth Century (whole and first half).

B. — *Physical sciences and Technology.*

Darmstaedter, Ernst. BENVENUTO CELLINI und seine Abhandlung über die Goldschmiedekunst. *Kultur des Handwerkes*, 7. Heft, 226-231, Juni 1927. ISIS

Wickersheimer, Ernest. Fumées industrielles et établissements insalubres à Rouen en 1510. *Annales d'Hygiène publique, industrielle et sociale*, 5e année, 9 p., Septembre 1927. ISIS

C. — *Natural Sciences.*

Spis o nových zemích a o novém světě. (On the new lands and the new world). Z prachu knihoven, Svazek 2. 96 p., Praha I, Benediktská 9, 1926. ISIS

Facsimile reprint of an early Czech booklet, printed by MIKULÁŠ BAKÁLAŘ, who was already printing in Plzeň (Pilsen) in 1488, and died in 1520. This pamphlet is a translation of a letter of « ALBERICUS » VESPUCCI to LORENZO PIERO FRANCESCO DI MEDICI; the Italian original of this letter is lost; a Latin

translation by JOCUNDUS, was printed in 1504. The Czech translation appeared at about the same time. The facsimile is followed by a reprint in Czech, English and Spanish translation and a note (in English and Spanish) by C. STRAHA, Librarian of the Strahov Monastery. This is a very elegant publication. G. S.

Stevenson, E. L. The geographical activities of the Casa de contratacion, *Annual report of the American Historical Association for the year* 1922, vol. I., p. 305-06, Washington, 1926. ISIS

D. — *Medical Sciences.*

Paracelsus. Volumen paramirum. (Von Krankheit und gesundem Leben). Herausgegeben und erläutert von JOH. DANIEL ACHELIS. 170 Seiten, 1 Port. Jena, DIEDERICHS, 1928. (br. M 4.50, geb. M. 6.50). ISIS

This edition is largely based upon JOHANN HUSER's Opera. It is preceded by an introduction (of 45 p.) and by a commentary (of 55 p.) both of which are subdivided in the same way as the text. This is convenient, though less so than if the notes had been printed at the bottom of the pages to which they refer. The purpose of this new edition will be best explained by using the very words printed on the jacket : « Der Heilkunde des PARACELSUS liegt die Weltanschauung von der Einheit alles Lebens zugrunde, in die auch der Mensch eingefügt und deren Ordnungen er unterworfen ist. Fällt er aus einer dieser Ordnungen heraus, so wird er krank und kann nur durch eine Gesamtbehandlung der inneren und der äusseren Ursachen in die ihm gemässe Ordnung zur Gesundung zurückgeführt werden. Deshalb ist für PARACELSUS die Gesamtbehandlung des Menschen, die seelische und körperliche gleich wichtig. Damit berühren sich seine Anschauungen mit der gegenwärtigen Krisis in unserer medizinischen Wissenschaft, die ebenfalls von der Spezialbehandlung sich löst und zur Gesamtbehandlung des ganzen Menschen übergeht. So antwortet PARACELSUS uns auf die immanenten Fragen der heutigen Zeit. Durch eine umfangreiche Einleitung und durch ausführliche Anmerkungen macht der Herausgeber, der Mitarbeiter SUDHOFFS an der Gesamtausgabe der Schriften von PARACELSUS, dieses wichtige Werk allgemein verständlich und praktisch nutzbar. » G. S.

E. — *Alia.*

Epistolae obscurorum virorum. Bd. I. und II. Hrsg. von ALOYS BÖMER. (Stachelschriften hrsg. von G. A. E. BOGENG. Ältere Reihe, I, 1,2). 165 S., 192 S. Heidelberg, RICH. WEISSBACH, 1924. ISIS

Fischer, Ludwig. VEIT TROLMANN VON WEMDING genannt VITUS AMERPACHIUS als Professor in Wittenberg (1530-1543). (*Stud. und Darst. a.d. Gebiet d. Geschichte* hrsg. von H. VON GRAUERT, X. Bd., H. 1). X + 215 p. Freiburg, HERDER & Co., 1926. ISIS

Reviewed by PAUL JOACHIMSEN in *Deutsche Literaturzeitung*, 1170-1171, 1927.

Kalkoff, Paul. Humanismus und Reformation in Erfurt (1500-1530). VI + 98 p. Halle, Buchh. d. Waisenhauses, 1926. ISIS

Reviewed by PAUL JOACHIMSEN in *Deutsche Literaturzeitung*, 1070-1075, 1927.

Landucci, Luca (1436?-1516). A Florentine diary from 1450 to 1516. Continued by an Anonymous writer till 1542, with notes by IODOCO DEL BADIA. Translated from the Italian by ALICE DE ROSEN JERVIS. Portrait and plates. London, DENT, 1927. ISIS

Mangan, John Joseph. Life, character, and influence of DESIDERIUS ERASMUS of Rotterdam. Two volumes. XVIII + 404 p., VII + 427 p. New York, MACMILLAN, 1927. ISIS

Reviewed in *American Historical Review*, 33, 108-110, 1927.

Pearson, Karl. On the skull and portraits of GEORGE BUCHANAN *Biometrika*, 18, 233-256, 32 pl., 1926. ISIS

XVIth Century (second half).

B. — *Physical Sciences and Technology.*

Dalton, Ormonde Maddock. CROFT LYONS bequest of early dials and other instruments. *British Museum Quarterly*, 1, 76-77, 1 pl., 1926. ISIS

This note is inserted here with special reference to the horiziontal dial made by ERASMUS HABERMEL of Prague, instrument maker to RUDOLF II and TYCHO BRAHE, who had worked before at Regensburg and Augsburg. G. S.

C. — *Natural Sciences.*

Luke, Harry Charles. A Spanish Franciscan's narrative of a journey to the Holy Land. Translated from the sixteenth century manuscript and edited with notes. VII + 83 p. London, Palestine Exploration Fund, 1927. ISIS

Martinotti, Giovanni. COSTANZO VAROLIO (1543-75) e il suo metodo di sezionare l'encefalo. 15 p. (*Studi e memorie per la storia dell' Università di Bologna*, vol. 9). Imola, PAOLO GALEATI, 1926. ISIS

(Montserrate, Antonio). The commentary of Father MONTSERRATE, S. J. on his journey to the court of Akbar. Translated from the original Latin by JOHN S. HOYLAND, and annotated by S. N. BANERJEE. LXVIII + 220 p. Bombay, Oxford University Press, 1922. ISIS

Reviewed by R. P. DEWHURST, *Journal of the Royal Asiatic Society*, 678-680, 1924.

Wagner, Henry Raup. Sir FRANCIS DRAKE's voyage round the world : its aims and achievements. 543 p., illus. San Francisco, JOHN HOWELL, 1927. ISIS

D. — *Medical Sciences.*

Brunn, W. von. Fragment des Gichtbuches eines Stralsunder Amtschirurgen des 16. Jahrhunderts. *Archiv für Geschichte der Medizin*, 19, 287-293, 1 Fig., 1927. ISIS

Delmas, Paul. Le vrai visage de LAURENT JOUBERT. *Aesculape*, 17, 118-19, 1927. ISIS

Biographie et portrait de LAURENT JOUBERT (1529-1583), traducteur et commentateur de GUY DE CHAULIAC. L. G.

Lint, J. G. de. BARTHELEMY CABROL, chirurgien du XVI^e^ siècle. *Bull. Soc. Hist. Méd.*, 21, 169-180, 1927. ISIS

Lint, J. G. de. Le chirurgien JEROME FABRICE AB AQUAPENDENTE (1537-1619). *Bull. Soc. Hist. Méd.*, 21, 181-190, 1927. ISIS

Morpurgo, Edgardo. La spezierie a Padova durante la peste del 1575-1576. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 47-51, 1926. ISIS

Morpurgo, Edgardo. Un Trattato sulla « melancholia » di un medico italiano della seconda metà del Cinquecento. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 38-44, 1926. ISIS

The physician alluded to in the title is ERCOLE SASSONIA, born in Padova 1551. G. S.

Nuyens, B. W. Th. Een autograaf van Mr. ADRIAEN VAN DEN SPIEGEL (1585). *Bijdragen tot de geschiedenis der geneeskunde*, 7, 491-498, 1927. ISIS

Pictor's Tract on the treatmeot of the renal calculus (1557). Facsimile, with English translation, by CHARLES GREENE CUMSTON. v + 35 + 63 p. London, ROUTLEDGE, 1925. (*not seen*). ISIS

E. — *Alia.*

Atanassiévitch, Xénia. L'influence des pythagoriciens sur un philo-

sophe italien. *Rev. de l'Université de Bruxelles*, 32, 400-408, 1927. ISIS

L'auteur montre comment l'hypothèse fondamentale de GIORDANO BRUNO « le minimum est la substance des choses » est établie sous l'influence du pythagorisme. L. G.

Conley, Carey Herbert. First English translators of the classics. 158 p. New Haven, Yale University Press, 1927. ISIS

Connes, Georges. Le mystère shakespearien. 264 p., portr. Paris, BOIVIN, 1926. ISIS

Forster, Edward Seymour. The Turkish letters of OGIER GHISELIN DE BUSBECQ (1522-1592), imperial ambassador at Constantinople, 1554-1562. Newly translated from the Latin of the Elzevir edition of 1633. Oxford, University Press, 1927. ISIS

Roberts, Griffith (fl. 1567-85). A Welsh grammar : and other tracts. 264 p. Carmarthen ,W. SPURRELL and Son, 1927. ISIS

XVIIth Century (whole and first half).

A. — *Mathematics.*

Biancoli, Bruno. GALILEO. *L'arduo*, 2, 18-22, 130-135, 1922. ISIS

Bosmans, H. (S. J.) A propos de la correspondance de DESCARTES avec CONSTANTIN HUYGENS récemment publiée par M. LÉON ROTH. L'auteur principal de l'Onwissen wiskontenaer I. I. STAMPIONIUS ontdeckt door JACOBUS A WAESSENAER (Leyde, 1640). *Rev. des quest. scientif.*, 11, 113-141, 1927. ISIS

La correspondance de DESCARTES avec CONSTANTIN HUYGENS récemment publiée par LÉON ROTH (*Isis*, 9, 434-7) fait tomber les derniers doutes qui pouvaient s'élever sur le fait que DESCARTES est le véritable auteur de ce « Faux Mathématicien I. I. STAMPION découvert », JACOB WASSENAER n'étant que le sécretaire qui traduit et qui signe. L'auteur fait l'histoire de la querelle latente entre DESCARTES et JEAN JANZ STAMPIOEN le jeune depuis 1633, mais que fit éclarter en 1639 l'apparition de l'Algebra of te nieuwe Stel-Regel de STAMPIOEN, Algebra qui n'était qu'un pastiche de la Géométrie de DESCARTES. Mauvais mathématicien, ce STAMPION eut l'honneur d'être le premier maître en mathématiques du grand HUYGENS. L. G.

Cajori, Florian. The logarithms of NAPIER. *Science*, 65, 547, 1927. ISIS

Duclaux; (Agnes) Mary (Frances). Portrait of PASCAL. Portr. New York, Harper, 1927. ISIS

Weis, Friedrich. EVANGELISTA TORRICELLI in seiner gesamten wissenschaftlichen Bedeutung unter besonderer Berücksichtigung der bis zum Ende des Jahres 1925 erschienenen Literatur. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 250-281, 1927. ISIS

B. — *Physical Sciences and Technology.*

von Dyck W. and **Caspar, M.** (*editors*). « Nova Kepleriana. Wieder gefundene Drucke und Handschriften von JOHANNES KEPLER. 4. Die Keplerbriefe auf der National-bibliothek und auf der Sternwarte in Paris », *Abhandlungen der Bayerischen Akademie der Wissenschaften*, Mathematish-naturwissenschaftliche Abteilung, vol. 31, Abh. 1, 1927. 114 pp. ISIS

In two of these Abhandlungen, in volume 25, Dr. VON DYCK published KEPLER's « Prognostica », of the years 1604 and 1624, found in the Munich state library, and KEPLER's « Glaubenserkenntnis » of the year 1623 found in Wittenberg. In volume 28 of the Abhandlungen appeared KEPLER's correspondance with EDMUND BRUCE which Dr. VON DYCK found in the British Museum. In the present article he presents a fourth batch of KEPLER material, namely eleven KEPLER documents dated 1622-1630, and letters of JACOB BARTSCH (KEPLER's son-in-law) and PETER CRÜGER to PHILIP MÜLLER, 1620-1635. (*Isis*, 1, 158; 5, 229; 7, 215). R. C. A.

Engelmann, Max. Schraubenmikrometer-Erstlinge. *Archiv für Geschichte der Mathematik, der Naturwissenschaften, und der Technik*, 10, 294-302, 5 Abb., 1927. ISIS

The micrometer-screw is often said to have been invented by WILLIAM GASCOIGNE, 1640. ENGELMANN describes two micrometer-screws, kept in the mathematical museum of Dresden : the one invented in 1609 by LUCAS BRUNN and constructed in 1619 by CHRISTOPH TRECHSLER, father and son; the other in an instrument built by MATTHAEUS HEINTZ of Zwickau, in 1631. G. S.

Hoppe, Edmund. MARCUS MARCI de Kronland. Ein vergessener Physiker des 17. Jahrhunderts. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 282-290, 1927. ISIS

MARCUS MARCI (1595-1667), disciple of GREGORIUS DE ST. VINCENTIO who taught mathematics in Prague 1629-31, was himself more of a physicist than a mathematician. The *De proportione motus* published by him in 1639 contains some valuable mechanical ideas mixed with errors. The same mixture of truth and error is found in his *Thaumantias liber de arcu coelesti deque colorum apparentium natura, ortu et causis* (Prague, 1648), but this work is very important because it contains the germ of the Newtonian theory of colors. Says the author « Wenn man heute in Betrachtungen zum 200 jährigen Todestage liest, dass NEWTON allein das Verdienst habe, den Nachweis er-

bracht zu haben, dass das Licht aus homogenen Strahlen bestehe, so entspricht das nicht der Wirklichkeit. Man muss vielmehr sagen : Der Gedanke, dass die farbigen Strahlen das weise Licht bilden, also die einzelnen Teile desselben sind, geht bis auf MAUROLYCUS (*Photismi de lumine et umbra* 1575) zurück, dass dieselben homogen sind, ist zuerst bewiesen von MARCUS MARCI 1648. Dass die Wiedervereinigung aller Farber des Spektrums durch eine passende Linse weiss ergibt, hat NEWTON zuerst bewiesen. »

Wenzel, A. GALILEI. VIII + 74 p., 10 fig. Berlin, OTTO SALLE, 1927.
ISIS

C. — *Natural Sciences.*

Barzini, Luigi. Le più belle pagine di FRANCESCO CARLETTI. Milano, TREVES, 1926. ISIS

Hondius, Jodocus. Reproductions of early engraved maps. 1 : The map of the world on MERCATOR's Projection, by JODOCUS HONDIUS, Amsterdam, 1608. From the unique copy in the collection of the Royal Geographical Society, with a memoir by EDWARD HEAWOOD. 26 sheets, 20 in. by 15 in., in paper cover. Memoir, 24 p. London, Royal Geographical Society, 1927. ISIS

Lawson, William. (fl. 1618). A new orchard and garden : or, the best way for planting, grafting, and to make any ground good for a rich orchard : particularly in the north, and generally for the whole common-wealth, as in nature, reason, situation, and all probability, may and doth appear. With the country house-wife's garden for herbs of common use. Their virtues, seasons, ornaments, variety of knots, models for trees, and plots, for the best ordering of grounds and walks. As also the husbandry of Bees, with their several uses and annoyances : all being the experience of forty eight years labour, by WILLIAM LAWSON, reprinted from the third edition with a preface by ELEANOUR SINCLAIR ROHDE. Whereunto is newly added the art of propagating plants with the true ordering of all manner of fruits, in their gathering, carrying home, and preservation. London, The Cresset Press, 1927.
ISIS

Reprint of this work of which the first edition appeared in 1618. It « ranks with GERARD's Herball and PARKINSON's Paradisus among the classics of English garden literature. WILLIAM LAWSON was the author of the earliest book written for northcountry gardeners, and in his New Orchard and Garden he includes the first known plan of a Yorkshire garden, which is here reprinted. His Country Housewife's Garden is remarkable as being the earliest book avowedly written for women gardeners. Miss ELEANOUR SINCLAIR ROHDE, whose name is familiar to all lovers of early English garden literature (see *Isis*, 5, 457-61 ; 8, 622), deals in detail with the small, homely garden of Elizabethan times. » G. S.

D. — *Medical Sciences.*

Dorveaux, Paul. Le baume vert de Metz. *Bull. Soc. hist. de la pharmacie*, 307-14, oct. 1926. ISIS

Ce baume vert de Metz (Balsamus vulnerarius Metensium), imaginé par SAMUEL DUCLOS (Metz 1589, 11, 18- id., 1684, 01, 21), et qui doit sa couleur au verdet qui figure dans sa composition, était employé surtout contre les suppurations; sa réputation a survécu jusqu'à nos jours, car il a été maintenu dans la dernière édition de l'Officine, de DORVEAULT (16e éd., p. 449, Paris, 1923). L. G.

Scaturro, Alberto. MARC ANTONIO ALAYMO (1590-1662) e i suoi « Consigli politico-medici per l'occorenti necessità di peste ». *Arch. di storia d. scienza*, 7, 216-225, 1926. ISIS

Etude bio-bibliographique sur ce médecin de Palerme. L'ouvrage dont s'occupe SCATURRO, bien qu'imprimé seulement en 1652, renferme des descriptions, des préceptes, tirés surtout de l'épidémie de peste qui sévit en Sicile en 1624-26. L. G.

Wilson, F. P. The plague in SHAKESPEARE's London. XII + 228 p., 16 pl. Oxford, Clarendon Press, 1927. ISIS

Deals mainly with the outbreaks of 1603 and 1625.

E. — *Alia.*

[Boehme, Jacob (1575-1624)]. Gedenkgabe der Stadt Görlitz zu seinem 300 jährigem Todestage. Herausg. von RICHARD JECHT. Im Selbstverlag des Magistrates der Stadt Görlitz, II + 132 S., Görlitz, 1924. ISIS

Compte rendu de A. KOYRÉ in *Rev. de l'hist. des religions*, 93, 328-333, 1926.

Chatterton, Edward Keble. JOHN SMITH (1580-1631). The Golden Hind Series. London, JOHN LANE, 1927. ISIS

Koyré, A. La littérature récente sur JACOB BOEHME. *R. de l'hist. des religions*, 93, 116-128, 1926. ISIS

Examen des trois ouvrages suivants : PAUL HANKAMMER, JACOB BOEHME, Gestalt und Gestaltung, 430 p., F. COHEN, Bonn, 1924; PENCKERT, das Leben JACOB BOEHME's 185 p., DIETRICHS, Jena, 1924; BORNHAMM, LUTHER und BOEHME (*Arbeiten zur Kirchengeschichte*, H. 2, 1925). L. G.

Taylor, Alfred Edward. FRANCIS BACON. (The British Academy : Annual Master-Mind Lecture, Henriette Hertz Trust.) (From the *Proceedings of the British Academy*). 24 p. London, Oxford University Press, 1927 (1926). ISIS

Wright, C. T. Hagberg. NICHOLAS FABRI DE PEIRESC (1580-1637) x + 56 p. For presentation to the members of the Roxburghe Club. London, 1927. ISIS

XVIIth Century (second half).

A. — *Mathematics.*

Brodetsky, Selig. Sir ISAAC NEWTON : a brief account of his life and work. XII + 161 p. London, METHUEN, 1927. ISIS

Ferrari, G. M. Il LEIBNIZ giudicato dal VICO. *L'arduo*, 1, 134-140, 1921. ISIS

Greenstreet, W. J. ISAAC NEWTON, 1642-1727. A memorial volume edited for the Mathematical Association. VIII + 181 p., 9 pl. London, BELL, 1927. ISIS

Hoppe, Edmund. Die Entdeckung der partiellen Differentialgleichungen. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 158-165, 1927. ISIS

« Es zeigt sich also, dass die Erfindung und Entwicklung partieller Differentialgleichungen weder mit der Newtonschen Fluxionsrechnung noch mit seiner Mechanik in gar keinen Zusammenhang weder historisch noch inhaltlich steht, sondern rein mathematisch entstanden und wesentlich durch geometrische Anwendungen entwickelt ist. Wenn dieselben auf physikalische Fragen angewandt wurden, waren es HUYGENS Lichttheorie oder solche Probleme der Mechanik, mit welchen sich NEWTON nicht beschäftigt hatte. Gerade in der ersten Zeit der Erfindung und Anwendung der partiellen Differentialgleichungen lehnte NEWTON diese Methode entschieden ab und sprach ihr gar keine Bedeutung zu. »

(Newton) Belopol'skii, A. A. The bicentenary of the death of ISAAC NEWTON. *Leningrad Akad. Sci.* S. S. S. R. Notes for a History of Science, I : 3-10, 2 portraits, 1927.

Krylov, A. N. NEWTON's sources. *Ibid.* I : 11-45, 1927.

Lazarev, P. P. NEWTON's works on optics. *Ibid.* I : 46-53, (in Russian) 1927. C. W. D. ISIS

Picard, Emile. Le deuxième centenaire de la mort de NEWTON. *Rev. de France*, 753-761, 15 avril, 1927. ISIS

Weis, Friedrich. Oratio de Historia cycloidis. Ein Beitrag zur Behandlung des Streites, der sich an die Erfindung der Cycloide knüpft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 345-355, 1927. ISIS

This hitherto unpublished lecture on the history of the cycloid was delivered

by JAMES BERNOULLI (1654-1705) in 1701 when he assumed for the third time the philosophical decanate in the University of Basel. G. S.

Wieleitner, Heinrich. ISAAK NEWTON. Zu seinem 200 jährigen Todestage, *Unterrichtsblätter für Mathematik und Naturwissenschaften*, 33, p. 103-107, 1927. ISIS

B. — *Physical Sciences and Technology.*

Hoppe, Edmund. OTTO VON GUERICKE. X + 66 p., 10 fig. Berlin, OTTO SALLE, 1927. ISIS

Middleton, William S. The medical aspect of ROBERT HOOKE. *Annals of Medical History*, 9, 227-243, 1927. ISIS

Mouy, P. Les lois du choc des corps d'après MALEBRANCHE. 94 p., Paris, J. VRIN, 1927. ISIS

Après un rappel des lois du choc chez DESCARTES et LEIBNIZ, l'auteur examine les trois formes qu'à prises chez MALEBRANCHE la loi du choc des corps : 1) dans les quatre premières éditions de la Recherche de la vérité (1675-1688), ch. IX de la 2e p. du livre IV : règles de la communication des mouvements; 2) Des lois de la communication des mouvements, 1692; 3) lettre à LEIBNIZ du 13 décembre 1698. Ces changements ont été déterminés par l'influence de MARIOTTE et de LEIBNIZ. L. G.

C. — *Natural Sciences.*

Cardini, Massimiliano. Gli albori della biologia moderna. FRANCESCO REDI (1626-1697). *Scientia*, 41, 25-34, 1927. Traduct. franç., suppl., 23-34. ISIS

Swammerdam, Jan (1637-80). Tractatus physico-anatomico-medicus de respiratione usuque pulmonum. In quo praeter primam respirationis in foetu inchoationem, aëris per circulum propulsio statuminatur, attractio exploditur; experimentaque ad explicandum sanguinis in corde tam auctum quam diminutum motum in medium producuntur. Leiden, 1667. *Opuscula selecta Neerlandicorum de arte medica.* Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt. p. 46-181, Amsterdam, 1927. ISIS

Reprint of the original edition of Leiden 1667, with Dutch translation. SWAMMERDAM is better known as one of the early students of minute anatomy, embryology and zoology, but he was also a very remarkable physiologist. The work here reprinted is a splendid study of the mechanical part of respiration. BORELLI is often quoted as being the first to make an experimental study of this, but the second part of his *De motu animalium* was published only fourteen years after SWAMMERDAM's treatise (Rome 1681). In the course

of this investigation, SWAMMERDAM discovered the essential difference in the lungs of the foetus before and after birth, this being of great medico-legal importance (see p. 118). G. S.

D. — *Medical Sciences.*

Calamida, U. Tavole anatomiche volanti a piani sovrapposti del Secolo XVII. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925). Siena, p. 133-139, 1926. ISIS

Three anatomical tables dated Milano, 1663; Milano, 1666; Roma, 1687. G. S.

Graaf, Regner de (1641-73). Tractatus anatomico-medicus de succi pancreatici natura et usu. *Opuscula selecta Neerlandicorum de arte medica.* Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt, p. 182-293, Amsterdam, 1927. ISIS

Reprint of chapters 1 to 7 (out of 11) of this great classic, with Dutch translation and portrait. It was first printed as a thesis in Leiden in 1664. The present edition is made after the edition of Leiden 1671; the translation being a reprint of the text published in Amsterdam 1686. It is hardly necessary to emphasize the importance of this treatise, one the most important in the history of physiology. G. S.

(Niesius, Benjamin). Inaugural medical debate on elephantiasis or lepra arabum by BENJAMIN NIESIUS, University of Strassbourg, July 1673. Translated from the original Latin by CHAPLAIN BENEDICT STETTER. Preface by O. E. DENNEY. *Annals of Medical History*, 9, 267-276, 1927. ISIS

Piccinini, Prassitele. Il concetto Lancisiano degli studii medici. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925). Siena, p. 29-30, 1926. ISIS

Apropos of the *De recta studiorum medicorum ratione instituenda* of GIOV. MARIA LANCISI (1654-1720), 1715. G. S.

Robinson, Herbert Spencer. The Harveian Orators. From EDMUND WILSON to the orator of the plague year. *Medical Life*, 34, 316-354, 2 pl., 4 portraits, 1927. ISIS

Sylvius, Franciscus de le Boë (1614-72). Oratio inauguralis de hominis cognitione, Leiden 1658. *Opuscula selecta Neerlandicorum de arte medica.* Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt. p. 1-45, Amsterdam, 1927. ISIS

Lecture delivered by SYLVIUS on Sept. 17, 1658, to inaugurate his professorship of medical practice in the Leiden University; it is a sort of philosophical introduction to his course. Latin text with Dutch translation. G. S.

E. — *Alia.*

Boutroux, Emile. Les vérités éternelles chez DESCARTES. *Thèse latine* traduite par M. CANGUILHEM. Préface de LÉON BRUNSCHVICG. 146 p. *Bibl. de philos. contempor.*, F. ALCAN, Paris, 1926. ISIS

« Si le XIX^e^ s. a été, comme le disait BOUTROUX, le siècle des cloisons étanches, si une division paradoxale du travail y a maintenu les philosophes dans le monde des généralités, à l'écart du travail positif du savant et des historiens, ce sont les deux thèses de 1874 (Les vérités éternelles chez DESCARTES; et, De la contingence des lois de la nature) qui devaient faire tomber les concepts à priori d'un positivisme illusoire et d'un empirisme systématique. La méditation de l'œuvre que nous publions est donc importante, non seulement parce qu'elle fait connaître de la pensée cartésienne, mais aussi parce qu'elle a marqué le point de départ pour la rénovation de l'histoire de la philosophie » Ces premières lignes de la préface de BRUNSCHVICG sont suivies de l'étude qu'il écrivit au lendemain de la mort de BOUTROUX pour la *Revue de Métaphysique et de morale* (29, 261-84, 1922; *Isis*, 6, 462), puis de la traduction de la thèse de BOUTROUX. L. G.

Rand, Benjamin (*editor*). The correspondence of JOHN LOCKE and EDWARD CLARKE. With a biographical study. Oxford, University Press, 1927. ISIS

Sinistrari, Ludovico Maria (Friar Minor, 1622-1701). Demoniality. Translated into English from the Latin with introduction and notes, by MONTAGUE SUMMERS. XLIII + 127 p. London, Fortune Press, 1927. ISIS

Wolf, Abraham. The oldest biography of SPINOZA. Edited with translation, introduction, annotations, etc. 196 p., 6 pl. London, GEORGE ALLEN and UNWIN, 1927. ISIS

« This biography is the oldest, and it is the only one written by one who knew SPINOZA personally, and loved him well, if not always wisely. It is obviously high time for a really reliable edition of it to be readily accessible. But in order to be of service to the wider English reading public I have also added a translation, an introduction, and annotations, and some of the most important additional biographical matter which was written before the better known but less valuable Life by COLERUS (1705). »

XVIIIth Century (whole and first half).

A. — *Mathematics.*

Brennecke, Rudolf. Die Verdienste LEONHARD EULERS um den Potentialbegriff. *Zeitschrift für Physik*, 25, 42-45, 1924. ISIS

Euler, Leonhard. Opera omnia. Series 1, vol. 15 : Commentationes analyticae ad theoriam serierum infinitarum pertinentes. Volumen secundum. Edited by G. FABER. X + 722 p. Leipzig, B. G. TEUBNER, 1927. ISIS

B. — *Physical Sciences and Technology.*

Hertzberger, Menno. Short-title catalogue of books written and edited by HERMAN BOERHAAVE, compiled with the assistance of E. J. VAN DER LINDEN. Preface by J. G. DE LINT. Amsterdam, HERTZBERGER, 1927. ISIS

Kalkschmidt, Eugen. Die Goldmacher JOH. FRIEDR. BÖTTGER und die Erfindung des europäischen Porzellans. 15. Aufl. 80 S. Stuttgart, DIECK and Co., 1926. ISIS

C. — *Natural Sciences.*

Clark-Kennedy, A. E. STEPHEN HALES : physiologist and botanist, 1677-1761. *Nature*, 120, 228-231, 1927. ISIS

Address delivered at Corpus Christi College, Cambridge, on June 16, 1927.

Steiger, Rudolf. JOHANN JAKOB SCHEUCHZER (1672-1733). 1. Werdezeit (bis 1699). (*Schweizer Studien zur Geschichtswissenschaft*, Bd. 15, Heft 1). 151 p. Zürich, Gebr. LEEMANN, 1927. ISIS

This is the first instalment of a biography of the great Swiss naturalist, SCHEUCHZER, the founder of the physical geography of high altitudes and one of the founders of palaeontology. It deals only with the years of childhood and youth, but is based largely upon unpublished documents. Let us hope that the author will soon complete a task so well begun. G. S.

D. — *Medical Sciences.*

Calamida, U. Di un carteggio inedito di GIUSEPPE ZAMBECCARI, 1681-1729. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 120-127, 1926. ISIS

Caullery, Maurice. L'histoire des fourmis de RÉAUMUR. *Revue scientifique*, 12 févr. 1927. ISIS

A propos du mémoire publié par W. M. WHEELER (*Isis*, 9, 445-7).

Chiadini, Massimo. Terza serie di carteggi inediti del MORGAGNI. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925) Siena, p. 146-153, 1926. ISIS

Franco, Enrico Emilio. Un anatomico italiano professore a Lisbona nel secolo XVIII. BERNARDO SANTUCCI da Cortona, 1701-1764. Atti del III Congresso Nazionale d. Soc. Ital. di stòria delle scienze mediche e naturali (Venezia, 1925), Siena, p. 91-96, 1926. ISIS

Lang, August. Medizinische Gerichtsbarkeit im alten Zürich (1714-1738). (*Züricher Medizingeschichtliche Abhandlungen* hrsg. von G. A. WEHRLI, 5) 64 S. Zürich, ORELL FÜSSLI, 1925. ISIS

E. — *Alia.*

Taylor, A. E. DAVID HUME and the miraculous. (The Leslie Stephen Lecture, 1927) 54 p. Cambridge, University Press, 1927. ISIS

XVIIIth Century (second half).

B. — *Physical sciences and Technology.*

Furlani, Giacomo. L'Opera di ALESSANDRO VOLTA nell'invenzione e nello studio della pila. *Periodico di Matematiche*, 7, 154-186, 1927. ISIS

Hahn, Paul. GEORG CHRISTOPH LICHTENBERG und die exakten Wissenschaften. Materialien zu seiner Biographie. 87 p. Göttingen, VANDENHOECK und RUPRECHT, 1927. ISIS

Hellmann, Gustav. Zur Geschichte der Wettervorhersage in Kalendern. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 291-293, 1927. ISIS

The calendar published officially since 1700 by the Preussische Sozietät der Wissenschaften (which became later the Prussian Academy) contained like all contemporary almanacs, weather prognostications. These were suppressed in 1779, probably at the initiative of LAMBERT and BEGUELIN, with the result that the calendar was boycotted by the farmers. The Academy was actually obliged, for commercial reasons, to reestablish the prognostications in 1780, and these continued until 1804. This experience was not a new one : in 1700, STURM, professor at Altdorf and, in the forties, ANDREAS MAYER, professor at Greifswald, had learned at their expense that it did not pay to publish almanacs without weather prophecies. G. S.

Hoffmann, Paul. ACHIM VON ARNIM über JOHANN WILHELM RITTER. *Archiv fur Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 357-362, 1927. ISIS

Lippmann, Edmund O. von. Ein Bildnis J. R. SPIELMANN's. *Chemiker-Zeitung*, Nr. 38, 1927. ISIS

JACOB REINHOLD SPIELMANN was GOETHE's instructor in chemistry.

Mieli, Aldo. ALESSANDRO VOLTA. (Profili). 87 p. Roma, FORMIGGINI, 1927. ISIS

Patterson, T. S. Soda, NICOLAS LEBLANC, and the French Revolution *Proceedings of the Royal Philosophical Society of Glasgow*, 53, 113-128, 1925. ISIS

A good account of LEBLANC's invention and of his tragic life, ended by suicide in 1806. G. S.

Przibram, Karl. LICHTENBERG als Physiker (150 Jahre LICHTENBERG-sche Figuren). *Die Naturwissenschaften*, 423-425, 1927. ISIS

Winderlich, Rudolf. Geschichtliche Notiz zur Verflüssigung der Gase. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 356, 1927. ISIS

Apropos of the experiments recorded by CHRISTOPH GIRTANNER in his Anfangsgründe der antiphlogistischen Chemie (Berlin 1792). G. S.

C. — *Natural Sciences.*

Chiadini, Massimo. Il naturalista forlivese FRANCESCO ANTONIO MAIOLI (1746-1823). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 153-157, 1926. ISIS

Febvre, Lucien. Un chapitre d'histoire de l'esprit humain. Les sciences naturelles de LINNÉ à LAMARCK et à GEORGES CUVIER. *Revue de Synthèse historique*, 43, 37-60, 1927. ISIS

Apropos of HENRI DAUDIN's Etudes d'histoire des sciences naturelles (2 vols., Paris, 1926) (*Isis*, 10, 502-505).

Gradenigo, Giuseppe. Sulle comunicazioni esistenti tra i canali semicircolari degli uccelli. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 139-145, 1926. ISIS

Apropos of ANTONIO SCARPA, *De structura fenestrae rotundae auris et de tympano secundario, anatomicae observationes*, Modena, 1772. SCARPA discovered the communications existing between the semi-circular canals of birds. G. S.

MacDonald, John. Travels in various parts of Europe, Asia, and Africa, 1745-1779. With introductions by JOHN BERESFORD. XXIV + 256 p., 7 pl. (Broadway Travellers' Series.) London, 1927. ISIS

The first edition of this work was printed at London, 1790, for the author « a cadet of the family of KEPPOCH in Inverness-shire, who after the ruin of his family in 1745, was thrown when a child upon the wide world ».

Manquat, M. Les opinions de GUENAU (1768), naturaliste, sur la génération spontanée et la variabilité des espèces. *Rev. des quest. scientif.*, 11, 70-87, 1927. ISIS

L'auteur voit en PHILIBERT GUENAU DE MONTBÉLIARD (Semur, 1720; id., 1785, 11, 28), collaborateur de BUFFON pour les premiers volumes de son Histoire naturelle, collaborateur à l'Encyclopédie en ce qui touche aux insectes, et auteur entre autres d'une « Histoire naturelle séparée contenant les observations de J. SWAMMERDAM sur les insectes, avec des notes et trente-six planches en taille-douce » (2 vol. 1768), le véritable précurseur de l'évolutionnisme. Passant en revue les textes *attribués* à THALÈS, ANAXIMANDRE, etc., ceux de LUCILIO VANINI, de BENOIT DE MAILLET, il les trouve vides au point de vue du transformisme et conclut que celui-ci date du milieu du XVIII[e] siècle. GUENAU est partisan de la génération spontanée. L. G.

Molinéry, Raymond. A propos du Traité sur les propriétés et les effets du café de M. B. MOSELEY (1786). *Bulletin la Soc. Fr. hist. Méd.*, 21, 90-96, 1927. ISIS

Woollacott, Arthur P. MACKENZIE and his voyageurs. By canoe to the Arctic and the Pacific, 1789-93. London, DENT, 1927. ISIS

D. — *Medical Sciences.*

Adami, J. George. CHARLES WHITE of Manchester (1728-1813) and the Arrest of puerperal fever, with which are reprinted CHARLES WHITE's published writings upon puerperal fever. 142 p. New York, PAUL B. HOEBER, 1923. ISIS

CHARLES WHITE was a distinguished surgeon, having studied under JOHN HUNTER, and was the first to excise the head of the humerus for caries, in place of amputation. He also employed dried sponge to arrest heamorrhage before anyone else in England, and has been called the « Father of Anthropometry. » His « Treatise on the Management of Pregnant and Lying-in Women » appeared in 1773, and was the first publication to insist on absolute cleanliness around a patient in the effort to prevent puerperal infection. Contains good discussion of historical opinions about puerperal fever, with commentary on the ideas of SEMMELWEIS. No index. C. D. L.

Barbosa Sueiro, M. B. MANUEL CONSTÂNCIO, a sua vida e a sua obra. *Arq. de anatomia e antropologia*, 9, 741-771, 1924-26. ISIS

MANUEL CONSTANCIO (1726,04,04 — 1817,07,14) anatomiste et chirurgien portugais. L. G.

Feis, Oswald. Nachgelassenes Gebet JOHANN CHRISTIAN SENCKENBERGS. *Archiv für Geschichte der Medizin*, 19, 297-299, 1927. ISIS

Feis, Oswald. Verhandlung über einen Fall sexueller Perversion aus dem Jahre 1776. *Archiv für Geschichte der Medizin*, 19, 293-297, 1927. ISIS

Gilbert, A. et Cornet, P. GUYTON DE MORVEAU et les « fumigations guytoniennes ». *Paris médical*, 26 juin 1926, I-IV. ISIS

Ces « fumigations » ont vu le jour en 1773, à la suite d'une épidémie de « fièvre infectieuse » causée par l'exhumation de cadavres que le gel terrible de l'hiver n'avait pas permis d'enfouir convenablement, à Dijon, la ville natale de GUYTON. L'épidémie fut arrêtée par des fumigations d'acide marin déphlogistiqué (chlore). L. G.

Pasinetti, Carlo. La legislazione antitubercolare della Republica di Venezia (1772-73-74) e sue vicende sotto i successivi governi. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 96-115, 1926. ISIS

Variot, G. L'anatomiste PIERRE CAMPER et sa doctrine sur l'éducation physique des enfants. Une aberration de J. J. ROUSSEAU. *Bull. la Soc. fr. hist. méd.*, 21, 134-145, 1927. ISIS

E. — *Alia.*

Arnhold, Erna. GOETHES Berliner Beziehungen. VIII + 456 p. Gotha, LEOPOLD KLOTZ, 1925. ISIS

Reviewed by FELIX HASSELBERG in *Deutsche Literaturzeitung*, 705-709, 1927.

Barthel, Ernst. Die Gegenwartsbedeutung der Goetheschen Farbenlehre. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 363-365, 1927. ISIS

Bentham, Jeremy. Plan for an universal and perpetual peace. With an introduction by C. JOHN COLOMBOS. 44 p. London, SWEET and MAXWELL, 1927. ISIS

Bouvier, Auguste. JOHANN GEORG ZIMMERMANN 1728-1795. Un représentant suisse du cosmopolitisme littéraire au XVIII^e siècle. VIII + 209 p. Genève, GEORG, 1925. ISIS

Reviewed by CHR. JANENTZKY, *Deutsche Literaturzeitung*, 2138-2141, 1926.

Delekat, Friedrich. JOHANN HEINRICH PESTALOZZI, der Mensch und der Philosoph. (*Diss.*) 48 p. Leizig, QUELLE and MEYER, 1926. ISIS

Griffith, Grosvenor Talbot. Population problems of the age of MALTHUS. 276 p., diagrams. Cambridge, University Press, 1926. ISIS

Newman, Bertram. EDMUND BURKE. Portrait. London, BELL, 1927. ISIS

Rousseau, Jean Jacques. Correspondance générale de J. J. ROUSSEAU. Éditée par THÉOPHILE DUFOUR. Vol. IV. Paris, COLIN, 1927. ISIS

Schuster, Julius. Wege zu GOETHES Naturwissenschaft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 365-366, 1927. ISIS

Souriau, Michel. Le jugement réfléchissant dans la philosophie de KANT. XII + 142 p. *Bibl. de philos. contempor.*, ALCAN, Paris, 1926. ISIS

Étude d'ensemble de la doctrine du jugement réfléchissant, doctrine qui forme le centre de la Critique du jugement. L'auteur suit l'évolution de la pensée de KANT à partir de la Critique de la raison pure (1781) où la faculté de juger est pour la première fois étudiée systématiquement et où l'on peut trouver le germe du jugement réfléchissant (1er chap.); il recherche (chap. 2) les sources historiques de l'esthétique et de la théologie de KANT, et étudiant la composition de la Critique du jugement, il situe la découverte de la faculté de juger réfléchissante entre mars 1788 et mai 1789; le dernier chap. est consacré à l'étude du jugement réfléchissant dans la Critique du jugement (1790). L. G.

XIXth Century (whole and first half).

A. — *Mathematics.*

(Gauss, Carl Friedrich). Briefwechsel zwischen CARL FRIEDRICH GAUSS und CHRISTIAN LUDWIG GERLING. Herausgeg. im Auftrage der Ges. z. Beförderung der gesamten Naturwissenschaften zu Marburg von CLEMENS SCHAEFER. XX + 820 p., portrait and facsimile. Berlin, OTTO ELSNER, 1927. ISIS

GERLING war zuerst Schüler von GAUSS und wurde mit der Zeit immer mehr mit ihm befreundet. Er war zuerst Lehrer am Lyzeum in Cassel, dann (1817-1864) Prof. für Physik, Mathematik und Astronomie an der Universität Marburg. Er setzte in Marburg die Errichtung eines Institutes für Physik (und Astronomie) durch, das 1841 etwas Auszerordentliches war. Auszerdem hat er sich durch die Vermessung von Kurhessen einen Namen gemacht. Von dieser Vermessung und von geodätischen Angelegenheiten handelt dieser Briefwechsel zu allermeist. Er schlieszt sich würdig an die Briefwechsel GAUSS-SCHUMACHER, GAUSS-OLBERS und GAUSS-BESSEL an, die bisher veröffentlicht wurden. Neben den Vermessungsangelegenheiten werden viele andere wissenschaftliche und technische Fragen berührt, wobei die grosze Ueberlegenheit von GAUSS in helles Licht tritt. Im Menschlichen wendet sich aber GAUSS vielfach an GERLING um Rat. Den noch kleinen Zeitverhältnissen steht die hohe Wissenschaftlichkeit der Gelehrten imponierend gegenüber. Ein sehr guter Index erleichtert die Benützung. H. W.

Lorey, Wilhelm. AUGUST LEOPOLD CRELLE zum Gedächtnis. *J. f. reine und angewandte Mathematik*, 157, 3-11, 1926. ISIS

Mack, Heinrich. C. F. GAUSZ und die Seinen. Festschrift zu seinem. 150. Geburtstage. XII + 130 + (20) p., 11 pl. (Werkstücke aus Museum, Archiv und Bibliothek der Stadt Braunschweig, II). Braunschweig, E. APPELHANS & Co., 1927. ISIS

Diese Schrift bildet eine vortreffliche Ergänzung des eben besprochenen Briefwechsels. Sie enthält nämlich lauter Familienbriefe mit zahlreichen Anmerkungen, ausgezeichnete Nachfahrentafeln und Familienbilder. H. W.

Müller, Franz Joh. Der Geodät JOH. LEONHARD SPÄTH aus Augsburg (1759 bis 1842). Der erste Mathematikprofessor der Münchener Universität. Ein nachträglicher Beitrag zum Münchener Universitätsjubiläum vom November 1926. *Bayer. Zeitschr. f. Vermessungswesen*, 26, 59-75, 1927. ISIS

Speiser, Andreas. Naturphilosophische Untersuchungen von EULER und RIEMANN. *J. f. reine und angewandte Mathematik*, 157, 105-114, 1926. ISIS

Stanford, Alfred. Navigator. The story of NATHANIEL BOWDITCH. XII + 308 p., portrait. New York, WILLIAM MORROW, 1927. ISIS

Biography of NATHANIEL BOWDITCH (1773-1838) of Salem, in the form of a novel. Interesting sidelights on the old Salem days of maritime enterprise. The author explains the genesis of BOWDITCH's work, his early love of mathematics, his growing desire to produce better nautical tables — the New American Practical Navigator —, finally the inception of his great undertaking, the translation of LAPLACE's Mécanique céleste (1829-39). A fascinating psychological study, based on the best sources, but the mathematical allusions are weak. G. S.

B. — *Physical Sciences and Technology.*

Arendt, Theodor. HEINRICH SAMUEL SCHWABE (1789-1875). Der Entdecker der Sonnenfleckenperiode. Sein Leben und sein Wirken. 56 S. Bessau, C. DÜNNHAUPT, 1925. ISIS

Bragg, Sir William. TYNDALL's experiments on magne-crystallic action. Supplement to *Nature*, 119, p. 61-72, 1927. ISIS

Brockman, C. J. Primary cells — a brief historical sketch. *Journal of chemical education*, 4, 770-780, 1927. T. L. D. ISIS

Crozet-Fourneyron, Marcel. Invention de la turbine : historique suivi d'une note sur un régulateur à mouvement louvoyant applicable aux turbines hydrauliques. Ouvrage couronné par l'Académie des Sciences. 55 p. Paris, CH. BÉRANGER, 1927. ISIS

Heyderhoff, Julius. Der junge BENZENBERG (1777-1846). Freund-

schaftsbriefe eines rheinischen Naturforschers der Goethezeit. Gesammelt und herausgegeben. 151 S., 8 Bildtaf. Düsseldorf, ED. LINTZ, 1927. ISIS

Klinckowstroem, Graf Carl von. SCHÖNFELD und sein technologisches Museum in Wien. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 96-101, 1927. ISIS

Metz, André. Le principe de CARNOT d'après M. EMILE MEYERSON. *Rev. des questions scientifiques*, 11, 37-58, 1927. ISIS

Rosse, Earl of (1800-67). The scientific papers of WILLIAM PARSONS, Third Earl of Rosse, 1800-1867. Collected and republished by the Hon. Sir CHARLES PARSONS. v + 221 p., 18 pl. Newcastle-upon-Tyne, Sir HOWARD GRUBB, PARSONS and Co, 1926. ISIS

Reviewed by W. H. S. in *Nature*, 119, 627-28, 1927.

Smith, Edgar F. A glance at the early organic chemistry in America. *Journal of Chemical Education*, 4, 1150-57, 2 fig., September 1927. ISIS

Wayling, H. G. A short biography of WILLIAM HYDE WOLLASTON, 1766-1828. *Science Progress*, 22, 81-95, 1927. ISIS

C. — *Natural Sciences.*

Addison, William H. F. The centenary of the discovery of the mammalian ovum. *Medical Life*, 34, 304-312, 2 pl., 1927. ISIS

(Castrén, Matthias). Academy of Sciences of the Union of Soviet Socialist Republics. Sketches of the History of Knowledge II. In memory of M. A. CASTRÉN on the 75th anniversary of his death. Academy Press, Leningrad 1927. small 8°. 141 pp. (Russian). ISIS

This beautifully printed little book is devoted to the memory of MATTHIAS CASTRÉN, the intrepid investigator of the Finnish tribes in the tundras of Northern Siberia (1831-1852). It deals with various aspects of his life and work, both personal and scientific, the different chapters being written by various specialists.. After a brief preface by S. OLDENBURG (p. 1-3), follow CASTRÉN — the Man and the Scholar (B. G. BOGORAZ, p. 3-35); an Altaiist and Ethnographer (L. J. STERNBERG, p. 36-56); as a Finnist (D. B. BUBRICH p. 57-64); as an investigator of the Samoyeds (N. N. POPPE, p. 65-75); as a worker in the Turkish and Mongolian fields (A. N. SAMOÏLOVIC; B. J. VLADIMIRTSOV, p. 76-92); his work among the Palaeoasiatic tribes (B. G. BOGORAZ, p. 93-108) and in Tungus (J. P. KOSHKIN, p. 109-130). A detailed bibliography by L. B. MODZALEBSKII (p. 131-141) closes the work. Several of the articles contain exposés and estimates of CASTRÉN's views and opinions in various fields (notably on anthropology, in which he was far in advance of

his time), and several of them contain a summary of the work done since CASTRÉN's day. R. P. BLAKE.

Ebstein, Erich. Aus ALEXANDER VON HUMBOLDTS Frühzeit. Mit zwei unbekannten Dokumenten (1795). *Mitt. zur Geschichte der Med. und der Naturwissenschaften*, 26, 169-172, 1927. ISIS

Lanzoni, Francesco. TOMMASO LUIGI BERTA, botanofilo parmigiano. *L'arduo*, 3, 106-111, 1923. ISIS

Note biographique sur ce botaniste (1783,11,11 — 1845,11,25).

Müller, Johannes (1801-58). Über die phantastischen Gesichtserscheinungen. Herausgegeben von MARTIN MÜLLER. (*Klassiker der Medizin*, hrsg. von K. SUDHOFF, 32). 101 S. Leipzig, J. A. BARTH, 1927. ISIS

Schuster, Julius. ALEXANDER VON HUMBOLDTS wissenschaftliche Anfänge. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 303-27, 1927. ISIS

Edition of fifteen letters written by HUMBOLDT in his youth (1790-1799). G. S.

Solov'ev, M. M. Guide to the exhibition in memory of the Academician, K. E. BAER. Leningrad Akad. Sci. S. S. S. R. Commission for the History of Science, 25 p., (in Russian) 1927. C. W. D. ISIS

D. — *Medical Sciences.*

Barkley, A. H. Dr. JOSEPH BUCHANAN. *Annals of Medical History*, 9, 222-226, 1927. ISIS

Born in Washington county, Virginia, 1785; died in Louisville, Kentucky, 1829.

Bragman, Louis J. LÄENNEC and CULPEPER as depicted by KIPLING. *Annals of Medical History*, 9, 129-131, 1927. ISIS

Bretonneau, Pierre (1771-1862). Die Diphtherie. Über die spezifischen Entzündungen der Schleimhaut oder die mit Belägen einhergehende Entzündung, bekannt unter dem Namen maligne Angina, gangränöse Angina usw. Nach dem 1826 ersch. französ. Orig. ins Deutsche übers. von MARIA NÜLLE. Mit einem Vorwort von ARTHUR SCHLOSSMANN. IX + 173 p., 3 fig. Berlin, SPRINGER, 1927. ISIS

Brougher, John C. WILLIAM SHARPEY (1802-1880). *Annals of Medical History*, 9, 124-128, 1927. ISIS

Castaldi, Luigi. REGOLO LIPPI e le sue vedute su linfatici (1825).

Atti del III Congresso Nazionale d. Soc. Ital. di storia delle science mediche e naturali (Venezia, 1925), Siena, p. 58-69, 1 fig., 1926. ISIS

Castaldi, Luigi. Vecchi tentativi di scroprire il segreto di GIROLAMO SEGATO (1792-1836). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 69-85, 1926. ISIS

Feldhaus, F. M. Zur Geschichte der Knochensägen. *Mitt. zur Geschichte der Medizin und der Naturwissenschaften*, 26, 280-81, 1927. ISIS

Invented by BERNARD HEINE of Würzburg in 1834. G. S.

Giordano, Davide. La chirurgia di ANDREA VACCÀ BERLINGHIERI. *Riv. di stor. d. sc. med. e natur.*, 18, 75-105, 1927. ISIS

ANDREA VACCÀ BERLINGHIERI (Pisa, 1772-Orzignano, près Pisa, 1826, 09, 06). Études en Italie, France, Angleterre. Travaux sur les fractures de côtes, sur la taille recto-vésicale (1821-25), sur la structure du péritoine, sur les maladies vénériennes; traité de chirurgie théorique et pratique (1813, inédit) qu'étudie surtout cet article. L. G. ISIS

Laignel-Lavastine, M. Sur le centenaire de la mort de LAENNEC. *Bull. Soc. fr. hist. méd.*, 21, 97-108, 1927. ISIS

Mauclaire, M. Description des tubercules osseaux, articulaires et ganglionnaires dans les manuscrits de LAENNEC. *Bull. Soc. fr. hist. méd.*, 21, 112-117, 1927. ISIS

Regnault, Félix. Le role du stéthoscope dans la découverte de LAENNEC. *Bull. Soc. fr. hist. méd.*, 21, 108-111, 1927. ISIS

Schroeder van der Kolk, J. L. C. An address on the neglect of care required for the assuagement of the fate of the insane and of the cure of same in our country. Delivered on occassion of the transfer of the rectoral dignity of the University of Utrecht, the 16th March 1837. (Utrecht, 1838). *Opuscula selecta Neerlandicorum de arte medica.* Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et editerunt. p. 294-351, Amsterdam, 1927. ISIS

SCHROEDER VAN DER KOLK was the reformer of the treatment of the insane in the Netherlands. He well knew the cruelty of the old treatment. When he had been appointed at the University of Utrecht he had witnessed the atrocious spectacle of an insane asylum being used as a place of public amusement. The address here reprinted was his reaction, a generous plea for the most unfortunate of our fellow men. In this respect he was a pioneer, if not in the world, at least in his own country. G. S.

Weve, H. J. M. Korte mededeeling betreffende een verdichte brillengeschiedenis. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 405-407, 1927. ISIS

Apropos of a little work on spectacles published in Ghent (1841; 2d ed. 1845) by Fr. EUG. DE CAESEMAEKER. G. S.

Williamson, R. T. PETER MERE LATHAM (1789-1875). *Annals of Medical History*, 9, 120-123, 127. ISIS

Wulff, Ove. Contribution à l'histoire de la lithotritie. *Janus*, 30, 301-341, 1926. ISIS

L'auteur insiste surtout sur le rôle de JEAN CIVIALE (1792-1867,06,18) et de LUDWIG LEWIN JACOBSON (Copenhague, 1783,01,10 — 1843,08,29). L. G.

E. — *Alia.*

Bohlin, Torsten. SÖREN KIERKEGAARDS Leben und Werden. Kurze Darstellung auf Grund der ersten Quellen. Übers. von PETER KATZ. 242 p. Gütersloh, C. BERTELSMANN, 1925.

Reviewed by HERMANN FABER, *Deutsche Literaturzeitung*, 1297-1300, 1927.

Horn, Emile Edouard. Un siècle de l'histoire de l'Académie hongroise. *Rev. des questions historiques*, 55, 134-147, 1927. ISIS

Les fondements de l'Académie hongroise furent posés dans une réunion tenue les 2 et 3 novembre 1825, et où fut importante l'influence de ETIENNE SZÉCHENYI; mais les travaux ne commencèrent vraiment qu'en 1831; après 1848, la domination autrichienne devint si dure que l'académie est obligée à renoncer à toute manifestation publique; elle ne reconquit une partie de son autonomie qu'en 1867. L. G.

Léon, Xavier. FICHTE et son temps. II, FICHTE à Berlin (1799-1813). Deuxième partie, La lutte pour l'affranchissement national (1806-1813). x + 330 pp. Paris, Librairie ARMAND COLIN, 1927. (40 frs.) ISIS

L'auteur a consacré une bonne partie de sa vie à l'étude de FICHTE. Dès 1902 il publiait « La Philosophie de FICHTE » (ALCAN); en 1922 il commençait la publication de l'ouvrage monumental dont voici le troisième volume. Le premier a été longuement analysé dans *Isis*, 4, 514-515; le deuxième parut en 1924 (*Isis*, 7, 246). La troisième partie étudie avec la même rigueur, et la même abondance d'informations, les dernières années de sa vie à Berlin : La lutte pour l'affranchissement national (1806-13) : 1. La guerre contre la France; 2. Les discours à la Nation allemande; 3. La fondation de l'Université de Berlin; 4. Les cours de 1810-1811; 5. Le rectorat de FICHTE; 6. Les cours de 1812-1813; 7. La guerre de 1813. La thèse principale de l'auteur c'est qu'il n'y a pas de « seconde philosophie » de FICHTE. « Les derniers ouvrages de FICHTE ne sont qu'un long effort pour maintenir, tout en parlant

le langage de la ' Philosophie de la Nature, ' le principe original de sa philosophie ' critique '. FICHTE est resté le disciple de la Révolution française; ce n'est pas lui qui en a renié les principes, mais NAPOLÉON. G. S.

Stein, Robert. Zur GÖRRESkunde. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 207-215, 1927. ISIS

XIXth Century (second half).

A. — *Mathematics.*

Barbarin, Paul. La correspondance entre HOUËL et DE TILLY. *Bull. des sc. mathémat.*, 50, 50-64, 74-88, 1926. ISIS

Publication de fragments de la correspondance échangée du début de l'année 1870 à la fin de 1885, entre G. J. HOUËL (1823-1886) et J. M. DE TILLY (1837-1906). L. G.

Hensel, Kurt. PAUL BACHMANN und sein Lebenswerk. *Jahresber. Dtsch. Math.-Ver.*, 36, 31-73, 1927. ISIS

Loria, Gino. Durante quarant' anni di insegnamento, confessioni e ricordi, *Bollettino di Matematica*, 1926, 18 pp. *Nel 40° anno di Insegnamento Universitario del Prof. Loria, Genova, 10 Dicembre*, 1926. 50 pp. + frontispiece portrait. ISIS

Professor LORIA was born at Mantua in 1862, received his doctorate at Turin in 1883 and since 1886 has been professor of higher geometry at the University of Genoa. He has been very active in publishing results of his researches, often in popular form, in the history of mathematics and in various parts of pure mathematics. There are more than 250 main titles in the list of his writings 1881-1926, and these include works to be found in every mathematical library of importance. His periodical *Bollettino di Bibliografia e Storia della Scienze Matematiche*, of which the first volume appeared in 1898, has been continued since 1922 as a *Sezione Storico-bibliografica* of *Il Bollettino di Matematica*. We felicitate Professor LORIA, distinguished and genial scholar, on the recognition of his notable achievements. R. C. A.

B. — *Physical Sciences and Technology.*

Balland, Antoine. Le centenaire de FRANÇOIS ZACHARIE ROUSSIN. *Bul. de la Soc. hist. pharmacie*, no 54, 373-6, 1927. ISIS

F.Z. ROUSSIN (1827,09,06 — 1894,04,08) pharmacien militaire, chimiste, toxicologue, auteur de la découverte des composés azoïques. L. G.

Feldhaus, Franz M. Ein Institut zur Untersuchung der Heizkraft vaterländischen Brennmaterials. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 194-195, 1927. ISIS

Apropos of PHILIPP WILHELM BRIX (1817-99). G. S.

Mangin, A. und **Tschikolew, W.** Drei grundlegende und gemeinverständlische Arbeiten zur Scheinwerferfrage. Übers. von A. SONNEFELD. (*Ostwalds Klassiker*, 219). x + 133 p. Leipzig, Akademische Verlagsgesellschaft, 1927. ISIS

Maxwell, James Clerk. The scientific papers of JAMES CLERK MAXWELL, edited by W. D. NIVEN. (Photographic reprint, by arrangement with Cambridge University Press.) Vol. 1, XXXII + 607 p., vol. 2, VIII + 806 p. Paris, J. HERMANN, 1927. ISIS

Mentré, F. ESPINAS technologue. *Rev. de métaphysique et de morale*, 34, 65-80, 1927. ISIS

Bien que VICTOR ALFRED ESPINAS (1844,05,23 — 1922, 02 24) n'ait publié sur la technologie (ou théorie des arts utiles) que ses Origines de la technologie (ALCAN, 1897), il n'a guère cessé, dans ses recherches sociologiques et son enseignement de la psychologie, à s'intéresser à une histoire générale de la technologie. L'auteur recherche comment ESPINAS a été amené à la technologie et publie quelques unes de ses pages inédites sur le sujet. L. G.

Noyes, William A. IRA REMSEN (1846-1927). *Science*, 66, 243-246, 1927. ISIS

Petrow, N., Reynolds, O., Sommerfeld, A., and **Michell, A. G. M.** Abhandlungen über die hydrodynamische Theorie der Schmiermittelreibung. Herausgegeben von L. HOPF. (*Ostwalds Klassiker*, 218). VI + 227 p. Leipzig, Akademische Verlagsgesellschaft, 1927. ISIS

(**Righi, Augusto,** Bologna 1850-1920). Le numéro entier de juin 1921 de l'*Arduo* (Bologna) est consacré au souvenir de RIGHI; O. M. CORBINO, Commemorazione di A. RIGHI ai Lincei ; — SEB. TIMPANARO : le ombre; — ANGELO PRATI : le figure elettriche e il moto dei ioni; GIULIO DALLA NOCE : RIGHI e il fenomeno di ZEEMAN. — Le dernier paragraphe du quatrième mémoire écrit par RIGHI sur la relativité est reproduit en fac-simile. — Au No de juin 1922 du même périodique un nouvel article général de S. TIMPANARO. L. G. ISIS

Rotth, August. Das Telephon und das Werden. Mit einem Geleitwort des Staatssekretärs Dr. FEYERABEND, Berlin, SPRINGER, 1927. ISIS

Reviewed by F. M. FELDHAUS, *Mitt. zur Geschichte der Medizin*, 26, 280, 1927.

Salvadori, Marco. Le centenaire de la naissance de G. B. DONATI. *Ciel et terre*, 25-30, portr., févr., 1927. ISIS

G. B. DONATI, Pise, 1826, 12, 16 — Florence, 1873, 09, 20. La découverte

de la « comète de DONATI » est de juin 1858. DONATI a découvert cinq autres comètes. L. G.

Stevens, F. W. JOSIAH WILLARD GIBBS and the extension of the principles of thermodynamics. *Science*, 66, 159-163, 1927. ISIS

Timpanaro, Sebastiano. PIETRO CARDANI. 6 p. extr. de *Il nuovo cimento*, N. S., anno 3, N. 1 -2, 1926. ISIS

Physicien, professeur à l'université de Parme, PIETRO CARDANI (Padova, 1858, 10, 21 — Parma, 1924, 12, 04), est surtout connu par ses travaux sur la décharge électrique. L. G.

Timpanaro, Sebastiano. Le richerche del RIGHI sul fenomeno foto elettrico. *L'Arduo*, 2, 66-75, 1922. ISIS

Walton, Frederick. The infancy and development of linoleum floorcloth. By its inventor. 56 p. London, SIMPKIN, MARSHALL, c. 1925. ISIS

C. — *Natural Sciences.*

(**Bateson, William** (1861-1926)). His life and work. By a fellow of the International Education Board. *The Journal of Heredity*, 17, 434-449, 1926. ISIS

Étude bio-bibliographique, accompagnée d'un beau portrait.

Brachet, A. Notice sur EDOUARD VAN BENEDEN. Annuaire de l'Académie Royale de Belgique, Bruxelles, 76 p., portrait, 1922. ISIS

Zoologiste et anatomiste belge,né à Louvain en 1846,décédé à Liége en 1910.

Emin Pasha (Eduard Schnitzer, 1840-92). Die Tagebücher von EMIN PASCHA. Band 4, VI + 448 p. Braunschweig, GEORG WESTERMANN, 1927. ISIS

Flexner, Simon. JACQUES LOEB and his period. *Science*, 66, 333-337, 1927. ISIS

Genevois, L. CHARLES HENRY et l'application des mathématiques à la biologie. *Rev. scientifique*, 97-100, portr., 26 févr. 1927. ISIS

Hervé, Georges, et Quatrefages, L. de. ARMAND DE QUATREFAGES DE BRÉAU. Médecin, zoologiste, anthropologue. *Bull. Soc. fr. Hist. Méd.*, 21, 200-231, 1927. ISIS

Keith, Sir **Arthur.** DARWIN's theory of man's descent as it stands today. Supplement to *Nature*, Sept. 3, 14-21, 1927. Also in *Science*, 201-08, 1927. ISIS

Presidential address before the B. A. A. S., Leeds, 1927.

Lohest, Max; Julin, Charles; et Rutot, A. Notice sur JULIEN FRAIPONT. Annuaire de l'Académie Royale de Belgique, Bruxelles, 69 p., portrait, 1925. ISIS

Zoologiste, paléontologiste, et préhistorien belge, né à Liége en 1857, y décédé en 1910. G. S.

(Mendel, G. J.) Pametni spis ku oslave stych narozenin J. G. MENDELA (Memorial volume in honor of the 100th birthday of G. J. MENDEL). 381 p. Prague, F. BOROVY, 1925. ISIS

Sacerdotti, C. CAMILLO GOLGI (1843, 04, 07 — 1926, 01, 27). *Arch. italiennes de biologie*, 76, 140-8, 1926. ISIS

Sars, Georg Ossian (1837-1927). Obituary by W. C. M. in *Nature*, 119, p. 822-23, June 4, 1927. ISIS

Schuchert, Charles. CHARLES DOOLITTLE WALCOTT, Paleontologist, 1850-1927. *Science*, 65, 455-458, 1927. ISIS

D. — *Medical Sciences.*

Aperlo, G. Nel 50. anniversario della morte di LUIGI PORTA (9 Sett. 1875-9 Sett. 1925). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 194-212, 1926. ISIS

With a portrait of this great Italian surgeon.

Ashhurst, Astley Paston Cooper. The centenary of LISTER (1827-1927), a tale of sepsis and antisepsis. *Annals of Medical History*, 9, 206-221, portrait, 1927. ISIS

Cheyne, Sir W. Watson. LISTER's methods in surgery. *Nature*, 120, 161-162, 1927. ISIS

Cyriax, Edgar F. The literature of the last fifty years on LING's medical gymnastics, with special reference to certain of his pecularities. *Janus* 31, 91-99, 1927. ISIS

Suite des travaux du même auteur précédemment mentionnés in *Isis*, 8, 571; 10, 194.

Foster, Hugh Molleson. FRANK PIERCE FOSTER; a memoir. Whole number of *Medical Life*, 34, 414-464, 1927. ISIS

F. P. FOSTER (1841-1911) was the author of the most scholarly medical dictionary of American origin (1888-93) and, for some time, editor of the *New York Medical Journal*. Biography with autograph and many portraits. G. S.

Gaglio, Gaetano. (1858-1925). Bibliographie de ses travaux et des travaux publiés sous sa direction; recueillie par L. SABBATANI. *Arch. italiennes de biologie*, 76, 76-87, 1926. ISIS

Cette bibliographie comprend 192 numéros qui ont presque tous trait à des études de pharmacologie.

Guerreiro, Luis. MANUEL BENTO DE SOUSA. *Arq. de anatomia e antropologia*, 9, 773-796, 1924-26. ISIS

Anatomiste portugais (1835, 12, 05 — 1899, 04, 29),

Hemmeter, John C. HEMMETER Festschrift number of *Medical Life*. *Medical Life*, 34, 154-254, April 1927. ISIS

Portraits. Bibliography of his writings, p. 231-239.

Holmes, Bayard. Medical history of Chicago. The condition of medical thought, medical practice and hospital service after the great fire and before the world's fair : 1871-1893. *Medical Life*, 34, 316-335, 2 portraits, 1927. ISIS

(**Lister, Joseph**). JOSEPH, BARON LISTER : centenary volume, 1827-1927. Edited for the Lister Centenary Committee of the British Medical Association by A. LOGAN-TURNER. XV + 182 p., 9 pl. Edinburgh, OLIVER and BOYD, 1927. ISIS

Manson-Bahr, Philip H. and **Alcock, A.** The life and work of Sir PATRICK MANSON (1844-1922). IX + 273 p., 12 pl. London, CASSELL, 1927. ISIS

Reviewed by J. F. C. HASLAM, *Nature*, 120, 468-9, 1927.

Menetrier, P. Sur quelques manuscrits de GABRIEL ANDRAL concernant l'histoire de la médecine. *Bulletin Soc. fr. hist. Méd.*, 21, p. 145-151, 1927. ISIS

Nolf, P. Notice sur CONSTANT VANLAIR. Annuaire de l'Académie Royale de Belgique, Bruxelles, 26 p., portrait, 1922. ISIS

Anatomiste, physiologiste et médecin belge, né à Créteil, France, en 1839, décédé à Liége, en 1914.

(**Osler**, Sir **William**). Sir WILLIAM OSLER Memorial Number : *Bulletin* no. IX *of the International Association of Medical Museums* and *Journal of Technical Methods*. Privately issued at 836 University St., Montreal, Canada, Foreword, XI pages, by WILLIAM H. WELCH. Proem, p. XIII — XVIII, by Sir CLIFFORD ALLBUTT. Editorial preface, p. XIX — XXII by MAUDE E. ABBOTT. 632 p., 1926. ISIS

Beautiful series of appreciations and reminiscences classified into editorials,

general articles, biographical, in memoriam, and bibliographical. The international scope of the tribute is shown by a list of the contributors, some of whom are Sir ARTHUR KEITH, PIERRE MARIE, ETTORE MARCHIAFAVA, KARL SUDHOFF, FIELDING H. GARRISON, WU LIEN-TEH, and F. J. SHEPHERD. There is included a bibliography of OSLER's writings taking up 130 pages. The volume is handsomely illustrated, and with HARVEY CUSHING's monumental biography, (*Isis*, 8, 358) should prove a valuable source-book. No index. C. D. L.

Riddell, Lord. Dame LOUISA ALDRICH-BLAKE (d. 1925, Ae 60). 91 p. London, HODDER and STOUGHTON, 1927. ISIS

(**Semon**, Sir **Felix**). The autobiography of Sir FELIX SEMON (1849-1921). Edited by HENRY C. SEMON and THOMAS A. MCINTYRE. London, JARROLDS, c. 1927. ISIS

Sherrington, Sir **C. S.** LISTER and Physiology. *Nature*, 119, 606-608, 1927. ISIS

Starling, Ernest Henry (1866-1927), physiologist. Obituary by C. J. MARTIN in *Nature*, 119, 715-721, 1927. ISIS

Tait, John. LISTER as physiologist. *Science*, 66, 267-272, 1927. ISIS

Tschirch, Alexander. Festschrift für ALEXANDER TSCHIRCH, zu seinem 70. Geburtstag am 17. Oktober 1926, gewidmet von Freunden und Schülern. XI + 448 p. Leipzig, HERM. TAUCHNITZ, 1926. ISIS

Vilhena, Henrique de. JOSÉ ANTONIO SERRANO. *Arq. de anatomia e antropologia*, 9, 382-414, 1924-26. ISIS

Notice biographique, bibliographique et critique sur J. A. SERRANO (1851, 10, 01 — 1904, 12, 07) professeur d'anatomie et de chirurgie à Lisbonne; plusieurs portraits. Dans le même fasc., VILHENA publie également quelques lettres de SERRANO (p. 579-634) et donne (489-578) le sommaire du cours d'angéiologie professé par SERRANO, d'après un exemplaire corrigé de sa main de son « Manual synoptico de anatomia descriptiva ». L. G.

E. — *Alia.*

Andler, Charles. Quelques sources de la philosophie intellectualiste de NIETSCHE (1876-81). *R. d'hist. de la philosophie*, 1, 69-102, 1927. ISIS

Horwitz, Hugo Th. Aus HERBERT SPENCERS Ingenieurzeit. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 170-90, 1927. ISIS

Mouy, P. L'idée de progrès dans la philosophie de RENOUVIER. *Thèse* Paris, 208 p. *Bibl. d'hist. de la philosophie*, J. VRIN, Paris, 1927. ISIS

En fait, cette thèse est un examen de la philosophie du progrès à travers tout le XIX^e siècle. Autour de la revue des opinions successives de RENOUVIER sur le progrès (sa foi dans le progrès dans le *Manuel de philosophie moderne* 1842; le recul qui se marque à ce point de vue dans le *Manuel de philosophie ancienne*, 1844; la critique de la philosophie du progrès : *Deuxième essai de critique générale*, 1859, *Science et morale*, 1869, articles de *La Critique philosophique*, 1875, 1880-83) et de l'examen critique de la valeur de l'idée de progrès, se groupe l'exposé, d'ailleurs fragmentaire et dispersé, des idées de SAINT-SIMON et des saint-simoniens, de FOURIER, de PROUDHON, AUG. COMTE, SPENCER. L. G.

Shurlock, Fredk. W. HERBERT SPENCER's electrical apparatus. *Nature*, 119, 672, 1927. ISIS

A note on this apparatus owned and made by WILLIAM GEORGE SPENCER, HERBERT's father, and by HERBERT himself. It is now the property of COLIN HYDE BENNETT in DERBY, England. G. S.

Sly, John F. The genesis of the universal postal union. A study in the beginnings of international organization. *International Conciliation*, No. 233, p. 393-444, New York, October, 1927. ISIS

XXth Century.

B. — *Physical Sciences and Technology.*

Addison, Col. **G. H.** (*editor*). The work of the Royal Engineers in the European War, 1914-1918. (Published by the Secretary, Institution of Royal Engineers, Chatham). Miscellaneous; the organization and expansion of the Corps, 1914-18; organization of engineer intelligence and information; camouflage service; concrete defence works and factories; forward communications; machinery, workshops and electricity; anti-aircraft searchlights; inundations; schools. III + 372 p. 100 pl. Chatham, W. and J. MACKAY, 1927. ISIS

Amundsen, Roald, and **Lincoln Ellsworth**. The first flight across the Polar Sea. With additional chapters by JOH. HÖVER, Hj. RÜSER-LARSEN, GUSTAV AMUNDSEN, FINN MALMGREN and B. L. GOTTWALDT. 274 p. London, HUTCHINSON and Co., 1927. ISIS

Armstrong, Henry E. RICHARD WILLSTÄTTER. (Scientific Worthies, 45). *Nature*, 120, 1-5, 1927. ISIS

Chwolson, Orest Danilovič. Die Physik 1914-1926. 17 ausgew. Kapitel. Uebersetzt von GEORG KLUGE. IX + 696 p. Braunschweig, VIEWEG, 1927. ISIS

Favaro, G. A. Un grande esempio di collaborazione scientifica : il

catalogo e la carta fotografica del cielo. *Scientia*, 41, 173-180, 1927 trad. franç., *id.*, suppl., 71-78. ISIS

Histoire du catalogue astrophotographique et de la carte photographique du ciel; indications sommaires sur l'état actuel des travaux. L. G.

Flettner, Anton. Mein Weg zum Rotor. 123 S., 114 Abb. Leipzig, KÖHLER und AMELANG, 1926. ISIS

Flettner, Anton. The story of the rotor. From the German « Mein Weg zum Rotor ». 110 p., 30 pl. London, CROSBY LOCKWOOD, 1927. ISIS

Haber, Fritz. Aus Leben und Beruf. Aufsätze, Reden, Vorträge. Mit einem Bildnis. VIII + 174 p. Berlin, SPRINGER, 1927. ISIS

Inhaltsverzeichnis : Zum 80. Geburtstage von CARL ENGLER (1922). — Die deutsche Chemie in den letzten 10 Jahren (1923). — Festrede zum 50jährigen Stiftungsfest des Akademisch-Literarischen Vereins in Breslau (1924). — Über Wissenschaft und Leben (1924). — Japanische Eindrücke (1924). — Ansprache an den japanischen Unterrichtsminister im Unterrichtsministerium bei Übergabe einer Sammlung deutscher Bücher (1924). — Wirtschaftlicher Zusammenhang zwischen Deutschland und Japan (1925). — Wissenschaftspflege (1925). — Über den Stand der Frage nach der Umwandelbarkeit der chemischen Elemente (1926). — Über die Grenzgebiete der Chemie (1926). — Ansprache bei der Eröffnung des Japaninstituts (1926). — Über Staat und Wissenschaft (1927). — Anhang : Die Notgemeinschaft der deutschen Wissenschaft (1921).

Millikan, Robert Andrews. Conceptions in physics changed in our generation. *Scientia*, 41, 255-264; trad. franç., *id.*, suppl., 107-116.

Rumpler, Edmund. Technisches über das Trans-Ozeanflugzeug. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 185-206, 9 Abb., 1927. ISIS

C. — *Natural Sciences.*

Akeley, Carl (1864-1926). Whole number of *Natural History* (vol. 27, no. 2, 115-179, New York 1927) devoted to him. ISIS

Articles by many, speaking of him as conservationist, explorer, sculptor, inventor, taxidermist. Abundant illustrations. G. S.

Marchal, E. Notice sur JEAN MASSART. Annuaire de l'Académie Royale de Belgique, Bruxelles, 90 p., 1927. ISIS

Botaniste belge, né à Etterbeek en 1865, décédé à Houx, Yvoir, en 1925.

Rasmussen, Knud Johan Victor. Across Arctic America; narrative of the fifth Thule Expedition. XX + 388 p., plates, portr. and maps. London, PUTNAM, 1927. ISIS

An abridged translation of Fra Grønland til Stillehavet.

D. — *Medical Sciences.*

Kraus, Richard. Zehn Jahre Südamerika. Vorträge über Epidemiologie und Infektionskrankheiten der Menschen und Tiere. 182 S., 108 Abb. im Text. Jena, FISCHER, 1927. ISIS

E. — *Alia.*

Defries, Amelia. The interpreter (PATRICK) GEDDES : the man and his gospel. XIII + 334 p., 9 pl. London, ROUTLEDGE, 1927. ISIS

Dwelshauvers, Georges. FREUD et la psychanalyse. *Revue de philosophie*, 25, 7-23, 125-152, 1927. ISIS

Deux conférences données au cercle thomiste de la faculté de philosophie de l'Institut catholique de Paris.

Lévy-Provençal, E. HENRI BASSET. *Hespéris*, 6, 1-4, 1926. ISIS

HENRI BASSET (Lunéville, 1892, 11, 07 — Rabat, 1926, 04, 13), fondateur de la revue *Hespéris*, s'était consacré à l'archéologie et à l'ethnographie marocaines. L. G.

Metz, André. EMILE MEYERSON et la critique de la raison. *Revue de philosophie*, 27, 64-88, 1927. ISIS

Mieli, Aldo. Un viaggio in Germania. Impressioni ed appunti di uno storico della scienza. *Archivio di storia d. scienza*, 7, 342-81, 1926. ISIS

Souvenirs sur E. DARMSTAEDTER, H. WIELEITNER, S. PLACZEK, C. MATSCHOSS, F. M. FELDHAUS, H. HAUSTEIN, H. E. SIGERIST, K. SUDHOFF, E. O. VON LIPPMANN, GRAF K. VON KLINCKOWSTROEM, etc. Plusieurs portraits. L. G.

Parodi, Dominique. La philosophie contemporaine en France; essai de classification des doctrines. 3e éd. revue et augmentée d'un appendice. VI + 537 p. Paris, FÉLIX ALCAN, 1925. ISIS

La première édition de l'ouvrage est de 1919 (*Isis*, 4, 421); l'appendice porte sur « la philosophie française de 1918 à 1925 ». Étude critique de R. LE SENNE in *Rev. de métaphys. et de morale*, 34, 81-114, 1927. L. G.

Poggendorff, J. C. Biographisch-literarisches Handwörterbuch für Mathematik, Astronomie, Physik, Chemie und verwandte Wissenschaftsgebiete. Band 5 : 1904-1922. Redigiert von P. WEINMEISTER. 1. und 2. Abteilung. 1423 p. Leipzig, Verlag Chemie, 1926. ISIS

PART II.

HISTORICAL CLASSIFICATION.

Including only the items which could not be included in Part I — the fundamental (centurial) classification. Hence a student of Muslim science, for example, should not peruse simply the notes collected below under the heading « Islam »; he should examine as well those included above under the headings VIIth Century, VIIIth Century, etc.

CONTENTS :

I. — *Antiquity* : 1. Antiquity (generalities) ; 2. Egypt ; 3. Babylonia and Assyria ; 4. Greece ; 5. Rome.

II. — *Middle Ages* : 6. Middle Ages (generalities) ; 7. Byzantium.

III. — *Oriental Science and Civilization* : 8. Asia (generalities; Western Asia ; Central Asia ; Eastern Asia) ; 9. India ; 10. China ; 11. Japan ; 12. Israel : 13. Iran ; 14. Islam.

I. ANTIQUITY.

1. — ANTIQUITY (*generalities*).

Belitz, Wilhelm. Wiederkäuer und ihre Krankheiten im Altertum. (*Abhandlungen aus der Geschichte der Veterinärmedizin*, Heft 12). 128 p. Leipzig, RICHTER, 1927. ISIS

Casson, Stanley. Macedonia, Thrace, and Illyria : their relations to Greece from the earliest times down to the time of PHILIP son of AMYNTAS. XXI + 357 p., 106 figs., 19 maps. London, Oxford University Press, 1926. ISIS

Reviewed by A. B. W., *American Historical Review*, 32, p. 906, July, 1927.

Cumont, Franz. Fouilles de Doura-Europos, 1922-23 (Haut-Commissariat de la République Française en Syrie et au Liban : Service des Antiquités et des Beaux Arts, Bibliothèque Archéologique et Historique, tome IX). LXVII + 533 p., 124 pl. Paris, GEUTHNER, 1926. ISIS

Reviewed by M. ROSTOVTZEFF, *American Historical Review*, 32, 836-41, 1927.

Delehaye, Hippolyte. Sanctus, essai sur le culte des saints dans

l'antiquité. VIII + 265 p. Bruxelles, Société des Bollandistes, 1927. ISIS

Reviewed by PATRICK J. HEALY, *American Historical Review*, 33, 173-4, 1927.

Garstang, J. The progress of Hittite studies. *Nature*, 119, 819-820, 860-62, 1927. ISIS

Glover, Terrot Reaveley. Democracy in the Ancient World. Cambridge, University Press, 1927. ISIS

Hahn, Eduard. Die Völker unter babylonischem Kultureinfluss. Auftreten des gehopften Bieres. (Bier und Bierbereitung bei den Völkern der Urzeit, II.) 102 p., illus. Berlin, 1927. ISIS

Heiberg, J. L. Geisteskrankheiten im klassischen Altertum. Sonderdruck aus *Allg. Zeitschrift für Psychiatrie*, Bd. 86 44 p. Berlin und Leipzig, W. DE GRUYTER, 1927. ISIS

Reviewed by KARL BIRNBAUM, *Deutsche Literaturzeitung*, 1576-78, 1927.

Jouguet, Pierre. L'Impérialisme macédonien et l'hellénisation de l'Orient. (*L'Évolution de l'humanité*, dirigée par HENRI BERR). XVI + 503 p., illus., maps. Paris, Renaissance du Livre, 1926. ISIS

Reviewed by W. S. FERGUSON, *American Historical Review*, 33, 95-97, 1927.

Niclot, Vincent. Les vers intestinaux dans la littérature médicale antique. *Paris médical*, 2 avril 1927, I-IX. ISIS

Osten, H. H. von der. Explorations in Hittite Asia Minor. *Amer. Journ. Semitic Lang. and Lit.*, 43, 73-176, 1927. ISIS

Asia Minor, including the land of the ancient Hittites, is part of an immense bridge which connects the territories of Far Eastern culture with those of the Mediterranean. A sketch of what is known of Hittite history here introduces an interesting description of an expedition of exploration in the Hittite region, which occupies the greater part of the paper. The story of the wanderings of the author and his companions is illustrated by a large number of reproductions from photographs. J. S.

Osten, H. H. von der. The ancient settlement at Kürigin Kaleh in Asia Minor. *Amer. Journ. Semitic Lang. and Lit.*, 43, 288-94, 1927. ISIS

The results of excavations at Kürigin Kaleh are described. It is concluded that the place, — a natural fortress, — is the site of an ancient settlement on the road which connected the ancient Ankuvah (Angora) with Hattushash (the capital of the great Hittite empire from about 1800 to about 1200 B. C.) J. S.

Petrie, Sir W. M. Flinders. Ancient weights and measures : illustrated

by the Egyptian collection in University College, London. VI + 52 p., 54 pl. London, Department of Egyptology, University College, 1926. ISIS

Rostovtzeff, M. I. The history of the ancient world. Volume I. The Orient and Greece. Translated from the Russian by J. D. DUFF. XXIII + 418 p. Oxford, Clarendon Press, 1926. ISIS

Reviewed by A. T. OLMSTEAD, *American Historical Review*, 32, 831-835, 1927.

Schlachter, Alois. Der Globus : seine Entstehung und Verwendung in der Antike nach den literarischen Quellen und den Darstellungen in der Kunst herausgegeben von FRIEDRICH GISINGER. (*Stoicheia*, Band 8). VIII + 118 p., 4 plates. Leipzig, TEUBNER, 1927. ISIS

Reviewed by E. ZINNER in *Deutsche Literaturzeitung*, 1078-1079, 1927.

Torrey, C. C. An inscription of ELIBA'AL, King of Byblos. *Journ. Amer. Or. Soc.*, 46, 237-240, 1926. ISIS

Records the discovery of a third Phœnician inscription, at Byblos, of earlier date than either the Moabite Stone or the Kalamu monument. The new inscribed object is a small statue of the Egyptian king OSORKON I (924-895 B. C.) We now have from this ancient city three royal inscriptions containing the same peculiar alphatetic forms; but we are still a long way from finding the beginnings of the Phœnician alphabet. J. S.

2. — EGYPT.

Budge, Sir E. A. Wallis. CLEOPATRA's needles and other Egyptian obelisks; a series of descriptions of all the important inscribed obelisks, with hieroglyphic texts, translations, etc. XXII + 308 p., 17 pl., 22 illus. in text. London, Religious Tract Society, 1926. ISIS

Carter, Howard. TUT-ENCH-AMUN. Ein ägyptisches Königsgrab. Entdeckt von Earl of CARNAVON und HOWARD CARTER. Bd II. Mit einem Beitrag : Zur Geschichte der ägyptischen Kunst von den Anfängen bis TUT-ENCH-AMUN von GEORG STEINDORFF. 303 p., 153 fig. Leipzig, F. A. BROCKHAUS, 1927. ISIS

Reviewed by A. SCHARFF, *Deutsche Literaturzeitung*, 1761-65, 1927.

Edgerton, W. F. Ancient Egyptian steering gear. *Amer. Journ. Semitic Lang. and Lit.*, 43, 254-265, 1927. ISIS

Egyptian sailors very early learned to set aside one or more oars on every large ship for the purpose of steering; but the manner in which the early steering oars were used is not evident. The question is argued by the author; and the subsequent development of the tiller is traced down to the time of HERODOTUS, with illustrations from the carvings of the tombs. J. S.

Erman, Adolf. The literature of the ancient Egyptians. Poems, narratives and manuals of instruction from the third and second millennia B. C. Translated into English by AYLWARD M. BLACKMAN. XVII + 318 p. London, METHUEN, 1927. ISIS

German edition Leipzig, 1923.

Garland, (Major) **H.** and **Bannister, C. O.** Ancient Egyptian metallurgy. XI + 214 p. London, CHARLES GRIFFIN, 1927. ISIS

Hurry, Jamieson B. IMHOTEP : the vizier and physician of King ZOSER and afterwards the Egyptian God of medicine. XVI + 118 p., 13 pl.. Oxford, University Press, 1926. ISIS

Reviewed by T. E. PEET, *Nature*, 120, 358-9, 1927.

Keimer, Ludwig. Von der Bedeutung der Naturwissenschaften für die Ägyptologie und umgekehrt. Dem grossen SCHWEINFURTH zum Gedächtnis. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 87-102, 7 Abb., 1927. ISIS

Meyerhof, Max. Eine 5000 Jahre alte wässerige Lösung. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 336-7, 1927. ISIS

Saline solution discovered by GEORGE REISNER in the tomb of HETEP-HERES, CHEOPS's mother (c. 3000 B. C.). This is the first time that water has been found in an Egyptian tomb. G. S.

Moret, Alexandre. La mise à mort du Dieu en Egypte. 59 p., 18 fig. Paris, P. GEUTHNER, 1927. (15 frs.) ISIS

Première conférence de la Fondation Frazer, Oxford, 1926. Les documents égyptiens confirment les hypothèses hardies formulées dans le *Rameau d'Or*. On trouve en effet en Egypte aussi bien que dans les pays explorés par Sir JAMES FRAZER des rites magiques pour régir les saisons et se procurer les deux choses fondamentales, nourriture et progéniture, et ces rites culminent dans le sacrifice d'un dieu, « the dying god ». G. S.

Neugebauer, O. Die Grundlagen der ägyptischen Bruchrechnung. VI + 45 p., 8 pl. Berlin, SPRINGER, 1926. ISIS

Reviewed by HEINRICH WIELEITNER, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 233-237, 1927.

Petrie, Sir **W. M. Flinders.** Glass stamps and weights : illustrated from the Egyptian collection in University College, London. VI + 28 p., 26 pl. London, British School of Archaeology in Egypt, University College, 1926. ISIS

Rey, Abel. Nouveau coup d'œil sur la mathématique égyptienne. *Revue de Synthèse historique*, 43, 27-35, 1927. ISIS

Scharff, Alexander. Grundzüge der ägyptischen Vorgeschichte. 69 p., 1 map, 111 fig. on 16 pl. (*Morgenland, Darstellungen aus Geschichte und Kultur des alten Orients*. Heft 12.) Leipzig, HINRICHS, 1927. ISIS

3. — BABYLONIA and ASSYRIA.

Albright, W. F. Note on the topography of ancient Mesopotamia. *Journ. Amer. Or. Soc.*, 46, 220-230, 1926. ISIS

Supplements and corrects the author's « A Babylonian Geographical Treatise on SARGON of Akkad's Empire », in vol. 45 of the above journal (see *Isis*, 9, 546-7). The author conducted investigations in Mesopotamia in the autumn of 1925. The search for Mari, one of his principal objectives, was quite unsuccessful, and the mystery remains. The author speaks of the vast number of mounds in the E. Tigris country; this region played a very remarkable role in the third millennium, when it was rich and prosperous; but its civilization declined after that time, since barbarian invasions brought about a wholesale destruction of Mesopotamian towns during the first part of the second millennium. A full description of the investigations, which should be of great interest, is to appear in the *Annual of the American Schools of Oriental Research*. J. S.

Contenau, Georges. Les tablettes de Kerkouk et les origines de la civilisation assyrienne. Extrait de *Babyloniaca*, tome 9, fasc. 2-4, 140 p., many illustrations. Paris, GEUTHNER, 1926. (50 frs.) ISIS

Darmstaedter, Ernst. Assyrische chemisch-technische Vorschriften und ihre Erklärung. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 72-86, 3 Abb., 1927. ISIS

Apropos of the texts published by H. ZIMMERN and independently by R. CAMPBELL THOMPSON (1925) (*Isis*, 9, 147) « Die Wiedergabe dieser Texte und ihre Deutung ist aber in beiden Ausgaben nicht ganz befriedigend, und es soll hier deshalb der Versuch gemacht werden, auf Grund der Arbeiten ZIMMERNS und THOMPSONS einen kombinierten neuen Text zu konstruieren, bei dem wir auch einige freundlich überlassene Bemerkungen von H. ZIMMERN verwerten. Wir versuchen dabei, nach ausführlicher Beschäftigung mit der Gesamtmaterie und mit Hilfe chemischer und technischer Überlegungen und Erfahrungen, ein etwas klareres Bild von dem technischen Wissen und Können der Babylonier und Assyrer zu geben, besonders auf dem Gebiete der Herstellung von Gläsern und Glasuren. »

Geers, F. W. A Babylonian omen text. *Amer. Journ. Semitic Lang. and Lit.*, 43, 22-41, 1926. ISIS

Assyro-Babylonian literature abounds in material relating to signs and portents, collected by a special class of priests, and classified and arranged systematically. Three classes of omens may be distinguished; those connected with and deduced from the observed consequences of every-day happenings (terrestrial, including historical, omens); those deduced from observations of the sky, constellations, eclipses, movements of the clouds, winds, etc.

(celestial omens) and a third group deduced from sacrificial animals (liver omens). A cuneiform tablet of the University of Chicago summarizes a number of terrestrial omens for the use of the incantation priest, from which predictions may be made about the course of a patient's ailment. The original is transcribed and a translation given. J. S.

Luckenbill, Daniel David. Ancient records of Assyria and Babylonia. 2 vols., XVI + 297 p.; XII + 504 p. Chicago, University Press, 1926. ISIS

Reviewed by ROBERT W. ROGERS, *American Historical Review*, 32, 835-36, 1927.

4. — GREECE.

Calhoun, George Miller. The growth of criminal law in ancient Greece. Berkeley, Cal., University of California Press, 1927. ISIS

Diès, Auguste. Le problème de l'un et du multiple avant PLATON. *Rev. d'hist. de la philos.* 1, 5-22, 1927. ISIS

Evans, George W. The Greek idea of proportion. *The American Mathematical Monthly*, 34, 354-57, 1927. ISIS

Heiberg, J. L. Mathematici Graeci minores. (*Det Kgl. Danske Videnskabernes Selskab. Historiskfilologiske Meddelelser*. XIII, 3). 107 p. Kobenhavn, ANDR. FRED. HOST & Son, 1927. ISIS

Contains the following texts : 1. DIDYMOS OF ALEXANDRIA (first half of first century B. C.). Measurement of timber; 2. DIOPHANES. Measurements of circles, polygons, spheres, cylinders. If d is the diameter, the circumference measures $d\ (3 + 1/7)$ and the surface of the circle $d^2 \times 11/14$; etc. (these two items fill more than half of the book; the Greek text is accompanied by a German translation; the following items are not translated); 3. Scholies to 2; 4. New scholies to EUCLID's Data; 5. ANTHEMIOS (first half of sixth century) and the Fragmentum bobiense; 6. Liber de ponderibus (in Latin). No glossary. A mathematical discussion of these texts is very desirable. G. S.

Heichelheim, F. Zum Weiterleben der griechischen Zahlenbuchstaben. *Zeits. d. Deut. morgenl. Ges.*, n. F., vol. 6, 78-81, 1927. ISIS

The author refers to HALLO's paper in vol. 5 of the above journal (see *Isis*, 9, 549), in which it is shown that the Greek use of letters as figures was taken up in various modes by other peoples, — Copts and Aethiopians, who took over the system mechanically, Jews and Syrians, who retained the original order but introduced small changes by the intercalation and elimination of individual letters, and Armenians, who retained only the principle, greatly altering the series by the introduction of numerous new signs. HALLO explained the notable differences in the reception of the Greek letter-numbers by the facts of national psychology. The present author would rather attribute the differences to the intensity of the Graeco-Roman civilization, — Egypt

having received a particularly strong impress of Hellenism, Armenia a relatively weak one. J. S.

Kaerst, Julius. Geschichte des Hellenismus. Bd. II Das Wesen des Hellenismus. 2. Aufl. XII + 409 p. Leipzig, TEUBNER, 1926. ISIS

Reviewed by JOSEPH VOGT in *Deutsche Literaturzeitung*, 1269-1272, 1927

Knorringa, H. Emporos; data on trade and trader in Greek literature, from HOMER to ARISTOTLE. 144 p. Amsterdam, H. J. PARIS, 1926. ISIS

Reviewed by VICTOR EHRENBERG in *Deutsche Literaturzeitung*, 1308-11, 1927.

Lacaze, André. Les théories musicales des philosophes grecs. *Rev. d'hist. de la philosophie*, I, 152-167, 1927. ISIS

Après avoir élevé une protestation contre le fait que les historiens se sont trop peu intéressés jusqu'ici à l'esthétique musicale propre aux penseurs grecs, l'auteur rappelle ce qu'il faut entendre sous le nom de caractère modal d'une mélodie, et en quoi la gamme des grecs était une « gamme descendante ». L. G.

Liddell, Henry George and **Scott, Robert.** A Greek-English lexicon. A new edition, revised and augmented throughout by HENRY STUART JONES, with the assistance of RODERICK MCKENZIE, and with the co-operation of many scholars. Part 3 : διάλειμμα — ἐξευτελιστής. p. 401-592, 2 p. addenda et corrigenda. New York, Oxford University Press, American Branch, 1927. ($3.50). ISIS

When the first part of the dictionary appeared in 1925, we devoted a long review to his great undertaking (*Isis*, 8, 200-02). It is pleasant to notice that the publication continues regularly, and considering its size, remarkably fast. The first three parts cover 592 large pages in small type, and carry us almost to the end of the letter ε; that is, almost a third of the whole work is already available. G. S.

Loria, Gino. Nota sopra un' antica soluzione del problema di Delo. *Il Bollettino di Matematica*, Sezione Storica-bibliografica, p. I-III, 1927. ISIS

Magnien, Victor. Les facultés de l'âme d'après PLATON, HIPPOCRATE et HOMÈRE. *L'acropole*, I, 300-314, 1926. ISIS

Il y a « identité foncière entre les idées d'HOMÈRE, les idées d'HIPPOCRATE et les idées de PLATON sur les facultés de l'âme, leur nature et leurs fonctions. » L. G.

Mayser, Edwin. Grammatik der griechischen Papyri aus der Ptolemäerzeit. Mit Einschluss der gleichzeitigen Ostraka und der in Ägypten verfassten Inschriften. Bd. II : Satzlehre. Analyt. Teil. Erste Hälfte. XX + 390 p. Leipzig, TEUBNER, 1926. ISIS

Reviewed by W. SCHUBART, *Deutsche Literaturzeitung*, 1558-60, 1927.

Myres, John Linton. The political ideas of the Greeks, with special reference to early notions about law, authority, and natural order in relation to human ordinance. 436 p. New York, Abingdon Press, 1927. ISIS

Ramsay, Sir Walter Marlow. Asianic elements in Greek civilization. (Gifford Lectures, Edinburgh, 1915-16). London, MURRAY, 1927. ISIS

Sigerist, Henry E. Antike Heilkunde (*Tusculum Schriften*, 7, 48 p. München, HEIMERAN, 1927. ISIS

« In den folgenden Zeilen soll nicht so sehr die Entwicklung der griechischen Medizin geschildert werden, als vielmehr ihr Wesen und ihre Leistung. Die Geschichte der griechischen Medizin umfasst etwa ein Jahrtausend. In dieser langen Entwicklungszeit haben sich die Anschauungen vielfach gewandelt. Der Wissensstoff hat sich von Jahrhundert zu Jahrhundert gewaltig gemehrt. Aber der griechische Arzt, der mit tastenden Versuchen am Anfang der Entwicklung steht und der Arzt, der mit ungeheurem Wissen beladen, die Entwicklung beschliesst, sie unterscheiden sich in ihrem ärztlichen Denken und Handeln nur wenig voneinander. »

Sudhoff, Karl. Kos und Knidos. Erschautes, Erforschtes und Durchdachtes aus der südöstlichen Aegaeis mit 5 Karten und 40 Abbildungen. 116 S. (*Münchner Beiträge*, Heft 4-5). München, Münchner Drucke, 1927. ISIS

5. — ROME.

Chapot, Victor. Le monde romain. (*L'Evolution de l'humanité*, dirigée par HENRI BERR). XV + 503 p. Paris, Renaissance du Livre, 1927. ISIS

Reviewed by R. V. D. MAGOFFIN, *American Historical Review*, 33, 97-98, 1927.

Homo, Léon. Les institutions politiques romaines, de la cité à l'état. (*L'Évolution de l'humanité*, dirigée par HENRY BERR). XVI + 471 p. Paris, Renaissance du Livre, 1927. ISIS

Reviewed by DONALD MCFAYDEN, *American Historical Review*, 33, 98-101, 1927.

Jullian, Camille. Histoire de la Gaule. Tome VIII. Les empereurs de Trèves. II. — La terre et les hommes, Paris, HACHETTE, 1926 ISIS

Volume I appeared in 1908.

Louis, Paul. Ancient Rome at work, an economic history of Rome from the origins to the empire. Translated by E. B. F. WAREING. (*The History of Civilization Series*). XIV + 347 p., 4 plates, maps. London, KEGAN PAUL, 1927. ISIS

Mattingly, Harold. A guide to the exhibition of Roman coins in the British Museum. 81 + 7 p., 8 pl. London, British Museum, 1927. ISIS

II. MIDDLE AGES.

6. — MIDDLE AGES (*generalities*).

Ciasca, Raffaele. L'arte dei medici e speziali nella storia e nel commercio florentino dal secolo XII al XV. (*Biblioteca Storica Toscana* a cura della R. Deput. Toscana di Storia Patria, IV) VI + 811 p. Firenze, LEO OLSCHKI, 1927. ISIS

Clark, Maude Violet. The medieval city state : an essay on tyranny and federation in the later Middle Ages. VIII + 220 p. London, METHUEN, 1926. ISIS

Reviewed by EUGENE H. BYRNE, *American Historical Review*, 33, 101-103, 1927.

Crumpt, Charles George and **Jacob, E. F.** (*editors*). The legacy of the Middle Ages. XII + 549 p., 42 pl. Oxford, Clarendon Press, 1926. ISIS

Reviewed by L. J. PAETOW, *Speculum*, 2, 225-227, 1927.

Dempf, Alois. Die Hauptform mittelalterlicher Weltanschauung. Eine geisteswissenschaftliche Studie über die Summa. 179 p. München, OLDENBOURG, 1925. ISIS

Reviewed by E. SEEBERG, *Deutsche Literaturzeitung*, 1841-46, 1927.

Dempf, Alois. Das Unendliche in der mittelalterlichen Metaphysik und in der Kantischen Dialektik. (*Veröff. d. kath. Inst. für Philosophie*, Band 2, Heft 1). VIII + 91 p. Münster i. W., ASCHENDORFF, 1926. ISIS

Ehrismann, Gustav. Geschichte der deutschen Literatur bis zum Ausgange des Mitelalters. Bd. II. Teil I : Die mittelhochdeutsche Literatur. 1 : Frühmittelhochdeutsche Zeit. 2 : Hälfte 1, Blütezeit. (*Handb. d. dtsch. Unterr. an höh. Schul.* begründ. von A. MATTHIAS, Bd. VI, T. II). XVIII + 358 p.; XVII + 350 p. München, C. H. BECK, 1922; 1927. ISIS

Reviewed by S. SINGER in *Deutsche Literaturzeitung*, 1262-66, 1927.

Ellis, T. P. Welsh tribal law and custom in the Middle Ages. Two volumes. XIV + 456; VI + 460 p., maps. Oxford, Clarendon Press, 1926. ISIS

Reviewed by F. N. ROBINSON, *American Historical Review*, 33, 104-107, 1927.

Gougaud, (Dom) Louis. Devotional and ascetic practices in the Middle Ages. English edition prepared by G. C. BATEMAN. XIII + 238 p. London, BURNS, OATES, 1927. ISIS

Original French edition, Paris, 1926.

Home, Gordon (Cochrane), and Foord, Edward. Mediaeval London. 382 p., illustrated. London, BENN, 1927. ISIS

Huelsen, Christian. Le chiese di Roma nel Medio Evo : Cataloghi ed appunti. 10 + 640 p., 2 plans. Florence, OLSCHKI, 1927. ISIS

Mackenzie, William Mackay. The mediaeval castle in Scotland. (The Rhind Lectures in archaeology, 1925-26). XII + 249 p. London, METHUEN, 1927. ISIS

Molsdorf, Wilhelm. Christliche Symbolik der mittelalterlichen Kunst. 2. erw. Aufl. XV + 294 p., 11 plates. Leipzig, K. W. HIERSEMANN, 1926. ISIS

First published under different title in 1920. Reviewed by HERMANN WOLFGANG BEYER in *Deutsche Literaturzeitung*, 993-995, 1927.

Pirenne, Henri. Les villes du Moyen Age : essai d'histoire économique et sociale. 206 p. Bruxelles, LAMERTIN, 1927. ISIS

Original text of the Princeton lectures published in English by the Princeton University Press, 1925.

Sternberg, Maximilian. Die Bedeutung der scholastischen Philosophie für das heutige medizinische Denken; eine historische und methodologische Studie. (*Abhandlungen zur theoretischen Biologie*, hrsg. von J. SCHAXEL, 24) 22 S. Berlin, BORNTRÄGER, 1926. ISIS

Thorndike, Lynn. Alfodhol and almadel : hitherto unnoted mediaeval books of magic in Florentine manuscripts. *Speculum*, 2, 326-331, 1927. ISIS

Waddell, Helen. The wandering scholars. XXVIII + 292 p. Boston, HOUGHTON MIFFLIN, 1927. ISIS

Reviewed by CHARLES H. HASKINS, *American Historical Review*, 33, 175-6, 1927.

Wells, John Edwin. Third supplement to a manual of the writings in Middle English, 1050-1400. Additions and modifications to June 1926. pp. 1161-1247. New Haven, Yale University Press, 1927. ISIS

7. — BYZANTIUM.

Ebersolt, Jean. La miniature byzantine. XIII + 110 p., 72 pl., 140 miniatures. Paris, VAN OEST,. 1926. ISIS

III. ORIENTAL SCIENCE AND CIVILIZATION.

8. — ASIA (*generalities*).

Western Asia.

Wensinck, A. J. Tree and bird as cosmological symbols in Western Asia. With a register comprising also « The navel of the earth » and « The ocean ». 56 p., illustrated. Verhandelingen der Koninklijke Akademie van Wetenschappen. Afdeeling Letterkunde. Deel 22, 1, 1921. ISIS

Central Asia.

Amitin-Shapori, Z. L. The popular medicine of the native (« Bokharean ») Jews in Turkestan. *Bulletin de l'Université de l'Asie Centrale* (Tashkent), 1-17, 1926. ISIS

In Russian with English summary.

Boyer, A. M.; Rapson, E. J.; Senart, E. Kharoṣṭhî inscriptions discovered by Sir AUREL STEIN in Chinese Turkestan. Part II : Text of inscriptions discovered at the Niya, Endere, and Lou-lan sites, 1906-7. Transcribed and edited. 119 p., 6 pl. Oxford, Clarendon, Press, 1927. ISIS

David-Neel, Alexandria. My journey to Lhasa; the personal story of the only white woman who succeeded in entering the forbidden city. Illustrated with many photographs taken by the author. XVIII + 310 p., plates, portraits. New York and London, HARPER, 1927. ISIS

Lüders, Heinrich. Medizinische Sanskrittexte aus Turkistan. (Festschrift für RICHARD VON GARBE). 15 p. Erlangen, PALM & ENKE, 1927. ISIS

Eastern Asia.

(Including works relative to the whole of Buddhist Asia, or to India, Central and Eastern Asia combined).

Coomaraswamy, Ananda Kentish. History of Indian and Indonesian art. 295 p., 400 illustrations on 128 plates. New York, E. WEYHE, 1927. ISIS

Schröder, E. E. W. Gs. A Phœnician alphabet on Sumatra. *Journ. Amer. Or. Soc.*, 47, 25-35, 1927. ISIS

The alphabets used in India are recognized as having sprouted from branches of the Phœnician; and it has been supposed that the alphabets of the Indian Archipelago have in turn been derived from India. There are several indigenous alphabets in Sumatra, the present paper being more particularly concerned with Batak, and the author appears to argue that the transference from Phœnician sources was not through India, but was more direct, though later modifications are due to Indian influence. Comparisons show that the Batak alphabet represents in its forms a transition stage between Phœnician and Aramaean, and that the period of its transference was between the beginning and end of the 7th century B. C. The geographical limits of the Phœnician alphabet are thus to be extended to the Indian Archipelago. J. S.

9. — INDIA

Ayyangar, M. S. Ramaswami, and **Rao, B. Seshagiri.** Studies in south Indian Jainism. 2 parts. Madras, HOE & Co., 1922. ISIS

Ayyar, R. S. Vaidyanatha. Manu's land and trade laws. Their Sumerian origin and evolution up to the beginning of the Christian era. With a foreword by Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, 164 p. Madras, HIGGINBOTHAM, 1927. ISIS

Chatterji, Suniti Kumar. The origin and development of the Bengali language. With a foreword by Sir GEORGE ABRAHAM GRIERSON. 2 parts. Part 1 : Introduction, phonology, XCI + 648 p. Part 2 : Morphology, Bengali index, p. 649 — 1179. Calcutta, University Press, 1926. ISIS

Datta, Bibhutibhusan. On Mûla, the Hindu term for « root ». *American Mathematical Monthly*, 34, 420-23, 1927. ISIS

Dey, Nundolal. Geographical dictionary of ancient and mediaeval India. *India Antiquary*, 55, Suppl. p. 215-262, 1926. ISIS

The completion of the work; see *Isis*, 8, 590. J. S.

Dutt, Binode Behari. Town planning in ancient India. 355 p., plans. Calcutta, THACKER, SPINK, 1925. ISIS

Edgerton, Franklin. The Bhagavad Gita or Song of the blessed one. India's favourite Bible. III + 106 p. Chicago, Open Court, 1925. ISIS

Reviewed by JARL CHARPENTIER, *Journal of the Royal Asiatic Society*, 802-03, 1925.

Havell, E. B. Indian architecture. Its psychology, structure, and history from the first Muhammadan invasion to the present day. Second edition, with many illustrations. London, MURRAY, 1927. ISIS

Hillebrandt, A. Die Anschauung über das Alter des Ṛigveda. *Zeits. d. Deut. morgenl. Ges.*, 6, 46-77, 1927. ISIS

The author comes to the conclusion that the period 1000-1200 B. C. represents approximately the date of the Brâhmaṇa literature, anterior to which the Ṛigveda is to be placed. But the actual date of the latter work, especially that of its beginning, is at present indeterminable, though it is not necessary to assume so remote a point as 1800 B. C. There appears to be no prospect of a solution of the problem, unless cuneiform inscriptions or excavations bring help. J. S.

Macdonell, A. A. India's past; a survey of her literatures, religions, languages and antiquities. 306 p., 35 illustrations, 4 maps. Oxford, Clarendon Press, 1927. ISIS

Mehta, Nânâlâl Chamanlâl. Studies in Indian painting; a survey of some new material, ranging from the commencement of the VIIth century to circa 1870 A. D. XI + 129 p., plates. Bombay, TARAPOREVALA, 1926. ISIS

Radhakrishnan, Sarvepalli. Indian philosophy. vol. 2. (*Library of Philosophy*). 797 p. London, ALLEN and UNWIN, 1927. ISIS

Rele, Vasant G. The mysterious Kundalini (The physical basis of the « Kundali (Hatha) Yoga » according to our present knowledge of Western anatomy and physiology). With a foreword by Sir JOHN WOODROFFE (ARTHUR AVALON). 112 p., 4 plates. Bombay, TARAPOREVALA, 1927. (Rs. 3/8). ISIS

This book is in the first place an account and an attempted explanation of the modification at will of certain physiological processes by a Yogi (religious devotee) of Bombay. The phenomena include stoppage of the radial and temporal pulse, and a short (six seconds) stoppage, or rather, as shown by cardiographic tracings, reduced amplitude, of the heart beats. The author, an Indian medical man, scarcely shows himself sufficiently critical in his

description of the phenemena ; the explanation which he suggests is a conscious control of the sympathetic nervous system, acquired through the exercises — maintenance of certain postures, practice of regulation of the respiration — that go to the making of a Yogi.

For the historian of science the important part of the book is that in which the author describes these exercises in detail, according to the Tantric manuals, and attempts an interpretation in the language of Western science of the anatomical terms used in the Sanskrit texts. Thus, for example, he identifies for us the several nerves « without the knowledge of which the process and technique of prânâyâma (the fourth of the eight stages in the training of the Yogi) is not possible ». The six chakras of the texts are supposed to be the sympathetic plexuses; and Kundalini, through which the stimulation of the chakras always takes place, is identified with the right vagus nerve. Other pseudo-anatomical and physiological terms also are explained in modern language. Several of the postures assumed during the physical exercises of the Yogi under training are illustrated by photographs.

It is impossible for a non-Sanskritist to judge how far the interpretations are likely to be correct; but the book will probably be found suggestive by future students and historians of ancient Indian anatomical and physiological science. J. STEPHENSON.

Shcherbatskii, Fedor Ippolitovich. La théorie de la connaissance et la logique chez les bouddhistes tardifs. Traduits par Madame I. MANZIARLY et PAUL MASSON-OURSEL. (*Annales du Musée Guimet, Bibliothèque d'Études*, t. 36) XI + 253 p. Paris, 1926. ISIS

Singh, Puran. The book of the ten masters. London, SELWYN and BLOUNT, 1927. ISIS

A history of the Sikh religion.

Strauss, O. Altindische Spekulationen über die Sprache und ihre Probleme. *Zeits. d. Deut. morgenl. Ges.*, n. F., vol. 6, 99-151, 1927. ISIS

A discussion of the ancient Indian speculations on the subject of speech, with an indication of their importance for wider problems of philosophy. J. S.

10. — CHINA.

Chang[1] Hung[2]-Chao[1] (390, 5269, 476). **Shih[2•] ya[3]** (9964, 12807). (Lapidarium sinicum). A study of the rocks, minerals, fossils and metals as known in Chinese literature. *Memoirs of the geological survey of China*, Series B, number 2, May, 1921. Peking, the Geological Survey of China, Ministry of Agriculture and Commerce. 2 + 4 + 8 + 348 + 2 + IX p., 11 pl. ISIS

Elaborate review by P. DEMIÉVILLE, *Bull. de l'École fr. d'Extrême-Orient*, 24, 276-301, 1924.

Handel-Mazzetti, Heinrich. Naturbilder aus Südwest-China : Er-

lebnisse und Eindrücke eines österreichischen Forschers während des Weltkrieges. XIV+380 p., 77 pl. Wien, Oesterreichischer Bundesverlag für Unterricht, Wissenschaft und Kunst, 1927. ISIS

Reviewed by A. HENRY in *Nature*, 119, 667-668, 1927.

Schmitt, Erich. Die Grundlagen der chinesischen Ehe. 223 p. Leipzig, BROCKHAUS, 1927. ISIS

11. — JAPAN.

Ireland, Alleyne. The new Korea. XII + 354 p., map. New York, DUTTON, 1926. ISIS

Katô, Genchi. A study of Shintô, the religion of the Japanese nation. X + 256 p., plates. Tokyo, Zaidan-Hôjin-Meiji-Seitoku-Kinen-Gakkai (Meiji Japan Society), 1926. ISIS

Murdoch, James. A history of Japan. Volume III. The Tokugawa epoch, 1652-1868. Revised and edited by JOSEPH H. LONGFORD, XVIII + 823 p. New York, GREENBERG, 1926. ISIS

Reviewed by K. ASAKAWA, *American Historical Review*, 33, 139-140, 1927.

12. — ISRAEL.

(Abot). The tractate « Fathers » from the Mischna, commonly called « Sayings of the Fathers » (Pirke Aboth). Edited with introduction, translation, and commentary by R. TRAVERS HERFORD. VII + 176 p. New York, Jewish Institute of Religion Press, 1925. ISIS

Reviewed by M. GUTTMANN in *Deutsche Literaturzeitung*, 793-795, 1927.

Abrahams, Israel. Hebrew ethical wills, selected and edited. 2 vols. (Schiff library of Jewish classics) 374 p. Philadelphia, Jewish Publication Society of America, 1926. ISIS

Hebrew text and English translation on opposite pages.

Benzinger, I. Hebräische Archäologie. (*Angelos-Lehrbücher*, Bd. 1) Dritte, neu bearbeitete Auflage. 431 Abb. im Text. Leipzig, EDUARD PFEIFFER, 1927. ISIS

Blunt, Alfred Walter Frank. Israel in world history. 127 p. Oxford, University Press, 1927. ISIS

Ehrentreu, Ernst. Untersuchungen über die Massora, ihre geschichtliche Entwicklung und ihren Geist. (*Beiträge zur semit. Phil. und*

Linguistik, hrsg. von G. BERSTRÄSSER, H. 6.) VII + 161 p. Hannover, HEINZ LAFAIRE, 1925. ISIS

Reviewed by LUDWIG BLAU, *Deutsche Literaturzeitung*, 1889-92, 1927.

Gandz, Solomon. The astrolabe in Jewish literature. *Hebrew Union College Annual*, 4, 469-486, Cincinnati, 1927. ISIS

Writings on the astrolabe are not as numerous in Hebrew as in Arabic. The following are dealt with : a treatise by IBN EZRA; JACOB BEN MACHIR's translation of a treatise by IBN AL-ṢAFFÂR (first half of eleventh century, see *Introduction* I, 716); an anonymous treatise. The author adds lists of sources in which the Hebrew transcription of the word astrolabe occurs, of other forms of this word and of other Hebrew and Arabic names. Following chapters deal with the astrolabe in Biblical exegesis and in Talmud and Halakhah. The last chapter contains the Hebrew terminology relative to various parts of the instrument. This will be very useful. G. S.

Henriques, Rose L. Mediaeval Hebrew minstrelsy : songs for the Bride Queen's Feast. Sixteen zemiroth arranged according to the traditional harmonies. Illustrated by BEATRICE HIRSCHFELD, and translated into English to fit the Hebrew tunes by HERBERT LOEWE. With a foreword by the (very Rev.) Dr. J. H. HERTZ. 134 p. London, J. CLARKE, 1926. ISIS

Jirku, Anton. Das Alte Testament im Rahmen der altorientalischen Kulturen. (Wissenschaft und Bildung, 219). 103 S. Leipzig, QUELLE & MEYER, 1926. ISIS

Reviewed by JULIUS LEWY, *Deutsche Literaturzeitung*, 1593-98, 1927.

Lowe, James H. Lehem lefi hat-taf; Tutorial preparation for Mishnoh and Gemoro, or Talmud without a master. 66 p. London, Hebrew Compendium Publishing Co., 1926. ISIS

Spivak, C. D. Longevity according to Hebrew lore and tradition. *Medical Life*, 34, 191-197, 1927. ISIS

14. — ISLAM.

Asin et Palacios, Michaël. Logia et agrapha domini JESU apud moslemicos scriptores, asceticos praesertim, usitata collegit, vertit, notis instruxit. (*Patrologia Orientalis*, tome XIII, fasc. 3 et 4) 198 p. Paris, 1916-26. ISIS

This very rich collection, splendidly edited, is derived from a large number of Arabic works, excluding the Qur'ân which has already been sufficiently analyzed from this special point of view. Don MIGUEL has read many Arabic theological works for his own studies and taken notes for this special purpose, but he has not tried to examine them exhaustively, except one, which is

indeed the most important, AL-GHAZZÂLÎ's Iḥyâ 'ulûm al-dîn. A few volumes have been examined for him by RIBERA, ALARCÓN and MASSIGNON, but the main bulk of this staggering work has been done by Don MIGUEL himself. Each relevant text is quoted in Arabic and in Latin translation. There are very good indices. The first part of this work has been reviewed in many periodicals, and various criticisms have been answered by the author in the *Revue Biblique* : In opus cui titulus « Logia et agrapha Domini JESU apud moslemicos scriptores, asceticos praesertim, usitata » animadversiones (reprint, 5 p., January 1927). G. S.

Castagné, Joseph. Le Congrès de turkologie de Bakou en mars 1926. *Revue du Monde Musulman*, 63, 15-126, 1927. ISIS

The Congress held at Baku was the first congress of Turkish studies. Some interesting discussions took place, e.g. on the Turkish dialects and the adoption of the Latin (instead of Arabic) alphabet to write them. Various newspapers and magazines have already adopted the Latin script, with a few additional letters. The next congress will meet at Samarkand. There are about 25 million Turks, of which less than one third are in Anatolia. G. S.

Devonshire, Henriette C. (Mme. **R. L.**) L'Egypte musulmane et les fondateurs de ses monuments. Paris, MAISONNEUVE Frères, 1926. ISIS

Fulton, Alexander S. and **Ellis, A. G.** Supplementary catalogue of Arabic printed books in the British Museum. 594 p. London, QUARITCH 1926. ISIS

Gandz, Solomon. Did the Arabs know the abacus ? (Yes). *American Mathematical Monthly*, 34, 308-316, 1927. ISIS

Heller, Bernard. Bibliographie des Œuvres de IGNACE GOLDZIHER. XVIII + 101 p. Paris, PAUL GEUTHNER, 1927. ISIS

This bibliography is one of the publications of the Ecole Nationale des Langues Orientales Vivantes. It is admirable drawn up and printed and it will be indispensable for every student of Islam. A good portrait is prefixed, with a biographical introduction by LOUIS MASSIGNON. The bibliography contains lists of the periodicals, collections and encyclopedias to which GOLDZIHER contributed : a list of his books and articles, dated year by year from 1862 to 1925 and containing 380 numbers; a list of reviews dated from 1873 to 1921 and numbered 381 to 590; titles of two maps which he drew up. Analyses in French are given of the principal books and articles written in Hungarian. It is fervently to be hoped that the project of republishing the more important of GOLDZIHER's fugitive articles will be carried out. Muslim studies cannot afford to lose any of his work. D. B. M.

Holmyard, E. J. Chemistry in Islam. *Scientia*, 40, 289-296, 1926; trad. franç., *id.*, suppl., 102-110. ISIS

Indications d'un caractère très général sur l'œuvre de JÂBIR, de AL-RÂZÎ,

AL-'IRÂQÎ, AL-JILDÂKÎ et sur la Rutbatu'l-ḥakîm, ainsi que sur les lacunes de notre connaissance de la chimie dans l'Islam. L. G.

Horten, Max. Die Philosophie des Islam in ihren Beziehungen zu den philosophischen Weltanschauungen des westlichen Orients. (*Gesch. d. Philos. in Einzeldarst.* Abt. I, Bd. 4.) 385 p. München, E. REINHARDT, 1924. ISIS

Reviewed by JOSEPH SCHACHT in *Deutsche Literaturzeitung*, 795-799, 1927.

Maack, Ferdinand. Talisman Turc; ein Beitrag zur magisch-quadratischen Dechifferierung von Liebes- und Krankheits-Amuletten, zum Ursprung und Wesen magischer Quadrate sowie zur wissenschaftlichen Periodologie. 180 p., 208 fig. Radeburg bez. Dresden, Dr. MADAUS & Co., 1926. ISIS

Macdonald, Duncan B. Articles siḥr and sîmiyâ'. *Encyclopaedia of Islam*, vol. 4, 409-417, 425-26, Leyden, BRILL, 1927. ISIS

Very elaborate study completed by an abundant select bibliography (on p. 416). G. S.

Nielsen, Ditlef (*editor*). Handbuch der altarabischen Altertumskunde. Herausgegeben in Verbinding mit FR. HOMMEL und N. RHODOKANAKIS, mit Beiträgen von ADOLF GROHMANN und ENNO LITTMANN. Band I., Die altarabische Kultur. VIII + 272 p. Copenhagen, ARNOLD BUSCK, 1927. ISIS

Reviewed by D. B. MACDONALD, *American Historical Review*, 33, 91-92, 1927.

O'Leary, De Lacy. Arabia before MUHAMMAD. (*Trubner's Oriental Series*). IX + 234 p., maps. London, KEGAN PAUL, 1927. ISIS

Revue du Monde Musulman. Index général des années 1906-1926 (vol. 1 à 66) rédigé par ANDRÉ FEVRET, ANDRÉ MARTIN, J. ROMAN D'AMAT. VI + 331 p. Paris, ERNEST LEROUX, 1927. ISIS

Cet ouvrage contient en réalité sept index : auteurs, noms de personnes, noms géographiques, ouvrages cités, périodiques cités, mots typiques, planches et cartes. Il est regrettable que ces index n'aient pas été mieux faits, du point de vue de l'arabisant; ils rendront cependant de grands services. G. S.

Rodd, Francis (James) Rennell. People of the veil; being an account of the habits, organisation and history of the wandering Tuareg tribes which inhabit the mountains of Air or Asben in the Central Sahara. XVI + 504 p. illus., London, MACMILLAN, 1926. ISIS

Ruska, Julius. Uber das Fortleben der antiken Wissenschaft im Orient.

Vortrag in der Berliner Gesellschaft für Geschichte der Naturwissenschaft, Medizin und Technik am 17. Juni 1927. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 112-135, 1927. ISIS

« Es ist die Welt des Faust, die uns der Orient geschenkt hat, eine Welt, die auch auf uns noch immer ihren Zauber ausübt. Aber es ist nicht nur diese Welt. Der alte Orient hat sich mit der griechischen Wissenschaft vermählt. Der neu zur Herrschaft gelangende Sternglaube verleiht der astronomischen und mathematischen Forschung wieder Flügel. Der Glaube an die Alchemie erzeugt die experimentelle Chemie. Die Hoffnung, eine Universalmedizin zu finden, die alle Krankheiten heilt, führt zur Reform der Arzneikunde. Wenn Sie an diese geschichtlichen Zusammenhänge denken, so werden Sie auch, das darf ich wohl hoffen, die Beschäftigung mit « arabischer » Wissenschaft nicht als zwecklose oder unzeitgemässe Bemühung betrachten, sondern als eine der dringendsten Aufgaben einer Geschichte der Naturwissenschaften anerkennen. »

Sékaly, Achille. L'Université d'el-Azhar et ses transformations. *Revue des études islamiques*, 1, 95-116, 1927. ISIS

« La grande Université musulmane de la Mosquée d'El-Azhar traverse depuis quelques années un malaise profond. Ce malaise se révèle périodiquement par des manifestations plus ou moins graves, quelquefois même par des troubles, que des réformes hâtives et des concessions plus ou moins opportunes viennent calmer momentanément et qui réapparaissent à la première occasion. D'où vient ce malaise, quelles en sont les causes, quelle est la portée exacte des réformes préconisées et réalisées au cours du dernier quart de siècle, quel serait le vrai remède pour faire disparaître ce malaise et redonner à ce célèbre établissement d'enseignement islamique son lustre et son importance de jadis ? »

Sharaf, Mohammad. An English-Arabic dictionary of medicine, biology and allied sciences. XXI + 971 p. Kairo, 1926. ISIS

Reviewed by MAX MEYERHOF, *Mitt. zur Geschichte der Medizin*, 26, 206-07 1927. To the previous works of the same kind mentioned by MEYERHOF, might be added the Latin-Arabic and Latin-Turkish anatomical glossary reviewed in *Isis*, 7, 272. RUSKA's remarks might be applied to the present work. G. S.

Sheringham, Arthur Thomas. Modern Arabic sentences on practical subjects; being selections from the newspapers of Iraq, Palestine, and Egypt. XI + 240 p. London, KEGAN PAUL, 1927. ISIS

Smith, David Eugene, and **Mourad, Salih.** The dust numerals among the ancient Arabs. *American Mathematical Monthly*, 34, 258-260, 1927. ISIS

Spies, O. CARL SCHOY und seine Schriften. *Zeits. d. Deut. Morgenl. Ges.*, n. F., vol. 5, 319-327, 1926. ISIS

A biographical notice of CARL SCHOY, b. 1877, d. 1925. A mathematician

and astronomer, he became attracted by the historical side of these subjects, learnt Arabic, and became the author of a lengthy list of papers dealing with the history of oriental astronomy and geography. J. S.

Wensinck, A. J. A handbook of early Muhammadan tradition, alphabetically arranged. XVIII + 469 p. Leiden, BRILL, 1927. ISIS

Reviewed by H. LAMMENS, *Revue des études islamiques*, I, 30-31, 1927.

Wieleitner, Heinrich. KARL SCHOY. *Jahresbericht der Deutschen Mathematiker-Vereinigung*, 36, 163-167, 1927. ISIS

With a portrait different from the one published in *Isis*, but probably made at the same time. G. S.

PART III.

SYSTEMATIC CLASSIFICATION.

Including only the material which could not be included in Parts I and II. Hence studies on Japanese astronomy or on XIIIth century astronomy are not classified below under astronomy, but above, respectively under Japan (in Part II) and XIIIth Century (in Part I).

The sections forming Part III are classified as follows:

I. *Science in general* : 15. Bibliography; 16. History; 17. Organization; 18. Philosophy.

II. *Formal sciences* (Knowledge of forms) : 19. Logic and Theory of Knowledge; 20. Mathematics; 21. Statistical methods.

III. *Physical sciences* (Knowledge of inorganic nature); 22. Mechanics ; 23. Astronomy; 24. Physics ; 25. Chemistry (Physico-chemistry, Industrial chemistry); 26. Technology.

IV. *Biological sciences* (Knowledge of organic nature) : 27. Biology (Generalities, « Natural history »); 28. Botany (Agronomy, Phytopathology, Palaeobotany); 29. Zoology.

V. *Sciences of the earth* (implying knowledge of both organic and inorganic nature): 30. Geodesy; 31. Geography and Oceanography ; 32. Geology, Mineralogy, Paleaontology, Mining ; 33. Meteorology, Climatology and Terrestrial Physics.

VI. *Anthropological and historical sciences* (Knowledge of man, past and present): 34. Anatomy; 35. Physical anthropology (anthropometry and races of man); 36. Physiology (human and comparative); 37. Psychology (human and comparative) ; 38. Archaeology (generalities, methods); 39. Prehistory; 40. Ethnology (primitive and popular science); 41. Superstition and Occultism.

42. Economics (economic doctrines and history; commerce; transportation and communications); 43. Sociology, Jurisprudence and Positive Polity ; 44. History of Civilization (general history, historical methods, biography and chronology); 45. History of Art (Art and science; Iconography; Arts and crafts); 46. History of Language, Writing and Literature; 47. History of Morals (Moral organization of society); 48. History of Philosophy; 49. History of Religion (Science and religion).

VII. *Medicine* : 50. History, organization and philosophy of medicine ; 51. Epidemiology, History of special diseases. Public health and Social medicine; 52. History of hospitals and of medical teaching; 53. Pharmacy; Pharmacology; Toxicology.

VIII. *Education* (The methods of accumulating, imparting and diffusing knowledge); 54 Education (Generalities, Methods, Colleges, Universities) ; 55. Academies, societies, congresses, National and international organization of science; 56. Bibliography. (Methods, Libraries) ; 57. Museology (Museums and Collections).

IX. 58. Alia; 59. Errata.

The applied sciences are not disconnected from the pure sciences, but, as far as possible, the principles and applications of science are considered in the same section. However, applications based upon the principles of many sciences are dealt with separately (ex. technology; medicine; education).

I. — SCIENCE IN GENERAL.

15. — BIBLIOGRAPHY of SCIENCE.

Scientific Periodicals. A world list of scientific periodicals published in the years 1900-1921. Vol. 2 : Abbreviated titles and locations of sets. XII + 344 p. London, Oxford University Press, 1927.

ISIS

16. — HISTORY of SCIENCE.

(Binoux, Prix). Le prix Binoux pour l'année 1926 a été attribué à M. HENRY DE VARIGNY pour son ouvrage: La mort et la biologie, signalé dans cette bibliographie critique (section biologie). Pour les prix des années antérieures, voir *Isis*, 8, 161-3, 725; 9, 370-2). L. G.

ISIS

Bloch, M. Kommission für Geschichte des Wissens an der Akademie der Wissenschaften d. U. S. S. R. *Mitt. zur Geschichte der Medizin und der Naturwissenschaften*, 26, 281-82, 1927. ISIS

Dannemann, Friedrich. Das Zusammenwachsen von Naturwissenschaft und Technik zur Einheit. 5 pages. Sonderdruck aus *Technik und Kultur*, Zeitschrift des VDDI. (undated, received in 1927). ISIS

Knickerbocker, William S. Classics of Modern Science (COPERNICUS to PASTEUR). XVI + 384 pp. New York, ALFRED A. KNOPF, 1927. ISIS

This anthology of modern science will make the teaching of the history of science easier, also the teaching of scientific English in technical schools. There are in all 36 texts by the following authors : F. BACON, N. COPERNICUS, J. KEPLER, G. GALILEI, W. HARVEY, R. BOYLE, C. HUYGENS, A. VON LEEUWENHOECK, I. NEWTON, B. FRANKLIN, LINNAEUS, J. BLACK, J. PRIESTLEY, H.

CAVENDISH, W. HERSCHEL, K. W. SCHEELE, A. L. LAVOISIER, A. VOLTA, P. S. LAPLACE, E. JENNER, Count RUMFORD, J. DALTON, M. F. X. BICHAT, A. AVOGADRO, H. DAVY, M. FARADAY, J. HENRY, C. LYELL, C. DARWIN, T. SCHWANN, H. VON HELMHOLTZ, L. PASTEUR, J. C. MAXWELL, A. WEISMANN, N. LOCKYER, and R. KOCH. The texts can be classified as follows : general science, 1 ; astronomy, 7 ; physiology, 1; physics, 9; biology, 3; botany, 1; chemistry, 8; medicine, 3; anatomy, 2; geology, 1. According to nationality: English, 16; German, 6; French, 4; Italian, 3; American, 3; Swedish, 2; Dutch, 2. Each text is preceded by a brief biography. I have read a few of them. They are very unsatisfactory, the author missing the essential points, insisting on trifles, and making erroneous or misguiding statements; e. g., LINNÉ did not discover the sexuality of plants; LYELL's views as quoted were only a stronger repetition of HUTTON's. G. S.

Lynch, Arthur. Science : leading and misleading. 376 p. London, JOHN MURRAY, 1927. ISIS

Reviewed in *Nature*, 120, 469-70, 1927.

Meyer, Adolf. Was heisst und zu welchem Ende studieren wir die Geschichte der Naturwissenschaften ? *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 37-53, 1927. ISIS

Ostwald, Wilhelm. Geschichtswissenschaft und Wissenschaftsgeschichte. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 1-11, 1927. ISIS

Reinke, Johannes. Geschichte und Naturwissenschaft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 12-15, 1927. ISIS

Ritter, Eugène. Trois chapitres de l'histoire des sciences. *C. R. Acad. des sc. mor. et politiques*, oct.-déc., 346-354, 1926. ISIS

Bref aperçu sur la lutte entre l'autorité écclésiastique et les copernicians, entre l'autorité dogmatique représentée par la Sorbonne, et les partisans de l'évolution du globe, entre la tradition biblique et l'idée de l'évolution du genre humain. Cette communication a été suivie d'observations d'EDOUARD LEROY (pp. 354-365) qui portent l'attention sur les problèmes généraux qui se posent à la pensée religieuse et à la pensée philosophique. L. G.

Ruska, Julius. Dritter Jahresbericht des Instituts für Geschichte der Naturwissenschaften zu Heidelberg. (Heidelberger Akten der von-Portheim-Stiftung.) 16 p. Heidelberg, CARL WINTER, 1927. ISIS

This is the last report sent by the present director of the Heidelberg institute, because he has been appointed director of the new and larger institute recently established in Berlin. It contains the history of the movement which has gradually led to the creation of the new institute, quoting extensively from an address delivered by Prof. PUSCHMANN of Vienna, in Heidelberg 1889. G. S.

Sarton, George. Der Neu-Humanismus. Autorisierte Uebersetzung von CARL GRAF KLINCKOWSTROEM. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 16-36, 1927. ISIS

Translation of The New Humanism, published in *Isis*, 6, 9-34, 1924.

Sarton, George. Introduction to the history of science. Volume I. From HOMER to OMAR KHAYYAM. (Carnegie Institution of Washington, Publication no. 376). XII + 839 p. Baltimore, WILLIAMS & WILKINS, 1927. (*$* 10.) ISIS

The Introductory chapter and Table of Contents were also printed separately (XII + 52 p., Washington, 1927; edition of 200 copies, out of print.) This first volume was reviewed (1) by J. W. S. JOHNSSON, in *Ugeskrift for Laeger*, Copenhagen 1927, no. 27, p. 578; (2) by FLORIAN CAJORI, in *Science*, 66, 260-262, 1927; (3) by J. K. WRIGHT, in *Geographical Review*, New York, October 1927; (4) by H. WIELEITNER, in *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 234, 1927; (5) by F. M. G. DE FEYFER, in *Bijdragen tot de geschiedenis der geneeskunde*, 7, 614-15, Amsterdam, 1927; (6) by C. SINGER, in *The Times Literary Supplement*, London, Oct. 20, 1927, p. 730; (7) by ALDO MIELI, in *Archivio di storia della scienza*, 8, 241-4, 1927; (8) by EDMUND O. VON LIPPMANN, in *Chemiker-Zeitung*, Nr. 66, p. 641, 1927; (9) by L. MASSIGNON, in *Revue des études islamiques*, 1927, 10 ; (10) by E. J. HOLMYARD, in *Nature*, vol. 120, 648-49, 1927.

Schuster, Julius. Die Geschichte der Naturwissenschaften und wir. Dem Archiv für Geschichte der Mathematik,der Naturwissenschaften und der Technik zum Geleit. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, I-VI, 1927. ISIS

Shipley, Maynard. The war on modern science : a short history of the fundamentalist attack on evolution and modernism. XIV + 415 p. New York, KNOPF, 1927. ISIS

Timpanaro, Sebastiano. La storia della scienza. *L'arduo*, I, 10-17, 1921. ISIS

Vernadskii, V. I. Ideas on the present importance of the history of science. *Leningrad Akad. Sci. S. S. S. R. Trav. Commission Hist. Sci.* I. 1-17, 1927. ISIS

17. — ORGANISATION of SCIENCE.

(Internal organization is meant, see *Isis* I, 195. For external, national or international, organization see section 55).

Washburn, Edward W. (*editor*). International critical tables of numerical data, physics, chemistry and technology. Prepared under

the auspices of the International Research Council and the National Academy of Sciences by the National Research Council of the United States of America. In 5 vols. Vol. I : XX + 415 p. New York, McGRAW-HILL Book Co., 1926. ISIS

Elaborate review by EZER GRIFFITHS in *Nature*, 119, 735-738, 1927.

18. — PHILOSOPHY of SCIENCE.

Dingler, Hugo. Der Zusammenbruch der Wissenschaft und der Primat der Philosophie. 400 S. München, ERNST REINHARDT, 1926. ISIS

Reviewed by DIETRICH MAHNKE, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 216-232, 1927.

Driesch, Hans. Metaphysik der Natur. (Handbuch der Philosophie). 95 S. München, R. OLDENBOURG, 1927. ISIS

Reviewed by E. O. VON LIPPMANN in *Chemiker-Zeitung*, 1927, Nr. 58.

Lodge, Sir **Oliver.** Science and human progress. (Halley Stewart Lectures, 1926). 187 p. London, ALLEN and UNWIN, 1927. ISIS

Reviewed in *Nature*, 120, 436, 1927.

Russell, Bertrand (Arthur William). The analysis of matter. London, KEGAN PAUL, 1927. ISIS

II. — FORMAL SCIENCES
(Knowledge of Forms).

19. — LOGIC and THEORY of KNOWLEDGE.

Enriques, Federigo. Zur Geschichte der Logik : Grundlagen und Aufbau der Wissenschaft im Urteil der mathematischen Denker. Deutsche Übersetzung von L. BIEBERBACH. (*Wissenschaft und Hypothese*, Band 26). V + 240 p. Leipzig, TEUBNER, 1927. ISIS

Prantl, Carl von (1820-1888). Geschichte der Logik im Abendlande. Manuldruck der Orig.-Ausgabe, 1855. 4 Bande. Leipzig, GUSTAV FOCK, 1927. ISIS

Original edition, Leipzig, 1855-1870.

20. — MATHEMATICS.

Becker, Oskar. Mathematische Existenz. Untersuchungen zur Logik und Ontologie mathematischer Phänomene. (Sonderdruck aus *Jahrb. Philos. u. phänomenolog. Forschung*, Bd. 8, herausgegeben von E. HUSSERL). VIII + 369 S., Halle a. S., MAX NIEMEYER, 1927. ISIS

Ein mit allen Mitteln der HUSSERL'schen Phänomenologie und mit ganz vorzüglichen Fach- und historischen Kenntnissen unternommener Versuch, die Frage nach dem « Seinssinn » des Mathematischen zu klären und die heute im Vordergrund stehenden Streitfragen über die Grundlagen der Mathematik historisch und kritisch zu beleuchten. Es ist kein Wunder, dasz der Verfasser mit dem Streit zwischen BROUWER und HILBERT (Intuitionisten und Formalisten) beginnt, wobei er mehr den Intuitionisten zuneigt und an den letzten Arbeiten HILBERTS eingehende Kritik übt. Das Problem dieses Gegensatzes wird bis ins Altertum zurückverfolgt, wo es uns als der Widerstreit zwischen den Anhängern einer kontinuierlichen (ANAXAGORAS) und einer atomistischen (DEMOKRITOS) Weltanschauung entgegentritt. Die Theorie des Kontinuums, das Problem des Unendlichen im Allgemeinen sowohl wie in Beschränkung auf die transfiniten Zahlen, werden ebenso durch die ganze Geschichte verfolgt. Dazu tritt gegen den Schlusz eine weit ausgreifende Untersuchung der Entwicklung des « Mathematisch-Formalen » mit eigenen Kapiteln über PLATON, ARISTOTELES, DESCARTES, LEIBNIZ und KANT. Ein mathematischer Anhang bezieht sich auf die neuesten Theorien. In den Fusznoten erscheint die reiche durchgearbeitete Literarur. Auch reine Historiker können viel aus dem Buch lernen. Leider fehlt ein Namenindex, der bei der Fülle des Stoffs sehr erwünscht gewesen wäre. H. W.

Behmann, H. Mathematik und Logik. (*Math.-phys. Bibl.*, 71). 59 S. Leipzig, B. G. TEUBNER, 1927. ISIS

Boutroux, Pierre. (1880-1922). Das Wissenschaftsideal der Mathematiker. (L'Idéal scientifique des mathematiciens dans l'antiquité et dans les temps modernes). Autorisierte deutsche Ausgabe von HILDA POLLACZEK. (*Wissenschaft und Hypothese*, Band 28). IV + 253 p. Leipzig, TEUBNER, 1927. ISIS

Original French edition Paris 1920 (*Isis*, 4, 93-96).

Carus, Edward Hegeler. Invariants as Products and a Vector Interpretation of the Symbolic Method. VIII + 44 pp. Chicago, The Open Court Publishing Co., 1927. ISIS

« The important discoveries of CLEBSCH and GORDAN in the theory of invariants were made by adopting the special method invented by ARONHOLD, called the symbolic notation. With this method of attack for the difficult problems of the theory of invariants, CLEBSCH and GORDAN proved that every invariant and covariant can be expressed as a sum of symbolic products. By developing relations between symbolic expressions CLEBSCH and GORDAN proved for the case of binary forms that all invariants and covariants of any form or set of forms can be expressed rationally in terms of a finite number; and they developed the method by which we can actually find this finite set of invariants and covariants for a given system.

« Our object is to connect the theorems of the symbolic notation with the ideas of vector analysis. The results may be of interest not only for the purpose of studying invariants but also for the further development of vector analysis. »

Coolidge, Julian Lowell. Einführung in die Wahrscheinlichkeits-

Rechnung. (*Sammlung Mathem.-physik. Lehrbücher*; Band 24.) Deutsche Ausgabe von FRIEDRICH M. URBAN. IX + 212 p. Leipzig, TEUBNER, 1927. ISIS

Forder, Henry George. The foundations of Euclidean geometry. XIII + 349 p., 1 plate. Cambridge, University Press, 1927. ISIS

« In the beginning of last century, it was still possible to regard the Greek Geometry as the most rigorously logical body of doctrine ever erected, for the mathematics of that day which was of modern origin was clearly based on insecure foundations. The critical mathematicians of the last century and of this have succeeded in placing Analysis on what seems to most an unassailable basis and the results of their labours are readily accessible in a number of excellent text-books. But although the Euclidean Geometry is the oldest of the sciences and has been studied critically for over two thousand years, it seems that there is no text-book which gives a connected and rigorous account of that doctrine in the light of modern investigations; for HILBERT's Grundlagen is a work of research, while the books of VAHLEN, SCHUR, VEBLEN and BAKER are preoccupied with Projective Geometry. It is hoped that this book will fill that gap. »

Gibson, G. A. « Sketch of the history of mathematics in Scotland to the end of the 18th century, Part 1 ». *Proceedings of the Edinburgh Mathematical Society*, series 2, vol. 1, part 1, pp. 1-18, 1927. ISIS

Thirty-four volumes of the *Proceedings* were published in the format 5 1/2 x 8 1/2 inches. This article is in the first part of the new series, which is of format 7 1/4 x 9 3/4 inches. In recent years there have been several publications of interest to the student of mathematics in Scotland; GIBSON's « Some criticisms of ROBERT SIMSON by SIR T. L. HEATH », *Proc. Edinb. Math. Soc.*, 44, 39-46, 1926; GIBSON's « JAMES GREGORY's mathematical work : a study based chiefly on his letters », *idem*, 40, 2-25, 1923; TWEEDIE's volume on JAMES STIRLING, 1922, and his earlier article in the *Mathematical Gazette*, 10, 119-128, 1920; TWEEDIE's « Study of the life and writings of COLIN MACLAURIN », (*Mathematical Gazette*, 8, 133-151, 1915, and 9, 303-305, 1919; the volumes edited for the NAPIER tercentenary celebration by HORSBURG (1914), and KNOTT (1915); and MACKAY's « Mathematical Correspondence, ROBERT SIMSON, MATTHEW STEWART, JAMES STIRLING », *Proceedings, Edinb. Math. Soc.*, 21, 2-39, 1903.

GIBSON's history deals with the mathematics at the four Scotch Universities, which were founded before 1600 : St. Andrews (1411), Glasgow (1450), Aberdeen (1495), and Edinburgh (1582). The first outstanding mathematician was JOHN NAPIER (1550-1617) and he was followed by JAMES GREGORY (1638-1675) and DAVID GREGORY (1661-1708). It is to this point that the first part of GIBSON's Sketch carries us. R. C. A.

Hancock, Harris. The « mystic » numeral 7. *American Mathematical Monthly*, 34, 293-296, 1927. ISIS

Journal für die reine und angewandte Mathematik (CRELLE's Journal), vol. 157, 1926-27. ISIS

This volume is a « Jubiläumsband » since the journal was founded in 1826. Among others the first volume contained four memoirs by ABEL, and five by STEINER. The jubilee volume differs from the usual volume by having fourteen pages of introductory matter and three full page supplements : *a*) portraits of PONCELET, MÖBIUS, STEINER, and PLÜCKER; *b*) SCHELLBACH, KUMMER, SCHRÖTER and HELMHOLTZ; *c*) GAUSS on the terrace of the Göttingen observatory. The introductory matter consisted of a sketch of the *Journal* and its editors by K. HENSEL (pp. 1-2); « AUGUST LEOPOLD CRELLE zum Gedächtnis » by W. LOREY, (pp. 3-11) and an extract of a letter from MITTAG-LEFFLER (pp. 12-14).

CRELLE's *Journal* was founded with GERGONNE's *Annales de Mathématiques Pures et Appliquées* (1810-32) as a model. Success in the undertaking was partly assured through an arrangement he made with the Kultusministerium whereby he was allowed to add to the title of the *Journal* the words to be found in every volume through 148, 1918 : « Mit tätiger Beförderung hoher Königlich Preussischer Behörden. » The « Beförderung » consisted on the one hand in issuing strong official recommendation of the *Journal* not only to universities, and institutions of a similar nature, but also, for example, to government boards and, through Prussian ambassadors, to foreign countries. On the other hand the « Beförderung » involved the purchase of a number of copies of the *Journal* which were distributed to various schools — a custom prevailing to very recent times. In this way WEIERSTRASS, for example, while a gymnasium pupil, received inspiration by discovering an uncut copy of the *Journal* « mit den schönen Abhandlungen von STEINER, von denen auch ein Primaner etwas verstehen konnte. » R. C. A.

Lietzmann, Walther. Aufbau und Grundlage der Mathematik. Ergänzungsheft 3 zum « *Math. Unterrichtswerk* ». 89 S. Leipzig, TEUBNER, 1927. ISIS

Behandelt in 4 Kapiteln die Logik in der Mathematik, die Grundlegung der Geometrie, die Grundlegung der Arithmetik und die Grundlegung der Analysis, leichtverständlich und anregend. H. W.

Lorey, Wilhelm. WILHELM AHRENS zum Gedächtnis. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 328-333, mit einem Bildnis, 1927. ISIS

WILHELM E. M. G. AHRENS (Lübz, Mecklenburg, 1872- Rostock 1927) was well known for his collections of mathematical recreations and anecdotes, the best of their kind. G. S.

Pasch, Moritz. Mathematik am Ursprung. *Gesammelte Abhandlungen über Grundfragen der Mathematik*. 4, 149 S. Leipzig, Felix Meiner, 1927. ISIS

Der Verfasser hat sich schon seit 1882, da seine « Vorlesungen über neuere Geometrie » erschienen (2. Aufl. 1926), und seine « Einleitung in die Differential- und Integralrechnung », mit den Grundlagen der Mathematik befasst. 1909 erschien sein Werk « Grundlagen der Analysis », das dann 1914 durch « Veränderliche und Funktion » ergänzt wurde. Daneben schrieb er noch eine Reihe von Aufsätzen in die *Annalen der Philosophie und philosophischen*

Kritik, und solche, aus der neuesten Zeit stammende Aufsätze sind es, die hier abgedruckt wieder sind. Zuerst zwei in denen der Versuch, die Geometrie auf empirische Axiome zu gründen, fortgesetzt wird : « Der starre Körper in der Geometrie » und « Die Begriffswelt des Mathematikers in der Vorhalle der Geometrie », dann ein Aufsatz im Anschlusz an (und zur Widerlegung von) VAIHINGERS Anwendung der « Philosophie des Als Ob » auf die Mathematik : « Der Begriff des Differentials », hierauf mehrere Abhandlungen unter dem gemeinsamen Titel « Begriffsbildung und Beweis in der Mathematik », ferner in Ergänzung zu den beiden ersten Aufsätzen ein solcher über « Dimension und Raum in der Mathematik », den Schluss bildet der allgemeine Artikel « Die axiomatische Methode der neueren Mathemathik ». — H. W.

Pasch, Moritz. Vorlesungen über neuere Geometrie. Zweite Auflage mit einem Anhang : Die Grundlegung der Geometrie in historische Entwicklung, von MAX DEHN. X + 275 S., 115 Abbildungen. Berlin, SPRINGER, 1926. ISIS

Der historisch orientierte Anhang von DEHN beginnt auf S. 185 und berücksichtigt 4 Gesichtspunkte : 1) Das Parallelenaxiom; 2) Die Grundlegung der projektiven Geometrie; 3) Die Stetigkeitsvoraussetzungen; 4) Die Axiomensysteme. H. W.

Sanford, Vera. The history and significance of certain standard problems in algebra. VIII + 102 pp. *Contributions to Education*, No. 251, Teachers College, Columbia University. New York, 1927. ISIS

« This study discusses the role of verbal or « clothed » problems in algebra. It describes the features that tend to make a problem appear to the pupil as real and important, even though it is not practical in everyday life. It also considers the use made in times past of mathematical recreations and of questions of current business, economic, or scientific interest, all of which have direct bearing on the work of the modern school. It analyses the reasons for the retention of certain problems and for the elimination of others, and gives the history of types which have persisted because of the reality to the pupil rather than because of any direct application to human needs. » Contents : 1. Why problems are taught; 2. Efforts to make problems interesting; 3. Methods of solving problems; 4. Commercial problems; 5. Genuine problems from scientific mathematics; 6. Recreations; 7. Pseudo-real problems in present-day text books; 8. Changes in problem material; 9. The future of problems; Bibliography.

Trinks, F. Geschichtliche Daten aus der Entwicklung der Rechenmaschine von PASCAL bis zur Nova-Brunswiga. *Die Braunschweiger G-N-C-Monatsschrift*, 14, 249-275, 1927. ISIS

Wieleitner, Heinrich. Zur Frühgeschichte des Imaginären. *Jahresbericht der deutschen Mathematiker-Vereinigung*, 36, 74-88, 1927. ISIS

Valuable clean-cut survey of work, particularly by CARDANO and BOMBELLI, with special reference to publications of E. BORTOLOTTI, 1923-25. R. C. A.

Wieleitner, Heinrich. Mathematische Quellenstudien im Unterricht. *Unterrichtsblätter für Mathematik und Naturwissenschaften*, 33. Jahrgang, 312-15, 1927. ISIS

Wieleitner, Heinrich. Mathematische Quellenstudien. *Das Weltall*, 26. Jahrgang, 186-91, 1927. ISIS

These two articles explain the necessity of refering to the old scientific sources, to go as near to these sources as possible. The argument is illustrated by means of well chosen examples. Special attention is paid to the excellent collection of source books, the Mathematisch-naturwissenschaftlich-technische Bücherei, published by OTTO SALLE, Berlin, and of which a few volumes are included in this bibliography (see WIELEITNER, KLIEM, WENZEL, HOPPE, FLADT). G. S.

Wieleitner, Heinrich. Rechnen und Algebra. (*Mathematische Quellenbücher*, 1.) VIII + 75 p., 5 fig. Berlin, OTTO SALLE, 1927. (Mk. 2) ISIS

The author has given us already a number of excellent books on the history of mathematics, but the present one, in spite of its small size, increases our debt to him quite considerably. It is an anthology of mathematical texts illustrating the development of arithmetic and algebra. Its high value is due to the editor's exceptional competence and to the careful selection and presentation of the items. The method is as follows : each item is reproduced as in the original or literally translated (without paying attention to diplomatic details; e.g. abbreviations are generally replaced by the full words); then this text is explained or translated into modern notation. The sources are very exactly indicated, and each item is briefly but clearly dated and otherwise located. This volume contains 23 items of which I mention at random nos. 5, 10, 15, 20 : Die Summe der geometrischen Reihe; Arabische Erbteilungsaufgabe; Erstes Auftreten des Logarithmenbegriffs als einer zweiten Umkehrung des Potenzierens; Einheitliche Behandlung der verschiedenen Formen der quadratischen Gleichung. We ought to have such books in English ! G.S.

Wieleitner, Heinrich. Geometrie und Trigonometrie. (*Mathematische Quellenbücher*, 2). VIII + 68 p. 22 fig. Berlin, OTTO SALLE, 1927. (2 Mk.) ISIS

The same general remarks apply to this book as to the first of the same series : Rechnen und Algebra. The case of geometry and trigonometry is somewhat different. With regard to geometry (i.e. elementary geometry); the evolution was essentially completed in the first half of the third century B. C. Trigonometry was a child of astronomy and thus was at first spherical. Its formal elaboration was considerably delayed; and did not reach a satisfactory stage until the eighteenth century, nor was its connection with geometry generally recognized before that time. Even now trigonometry is still too often dissociated from elementary geometry. This anthology contains 21 items; I quote nos. 1, 6, 11, 16, 21 : Das Möndchen des HIPPOKRATES; Der Ptolemäische Lehrsatz; Näherungskonstruktion des regelmässigen Fünfecks; Der

sphärische Sinussatz, abgeleitet an einem rechtwinkligen Dreieck; Der Moivresche Lehrsatz. This volume, as also the earlier one, is followed by a small dictionary of authors and editors quoted. Very good indeed. G. S.

III. — PHYSICAL SCIENCES
(Knowledge of inorganic nature).

22. — MECHANICS.
(*Including Celestial Mechanics.*)

Carmichael, Robert D. (and others). A Debate on the Theory of Relativity. With an introduction by WILLIAM LOWE BRYAN. VIII + 154 pp. Chicago, Open Court Publishing Co., 1927 ($ 2.00) ISIS

Debate organized by the Indiana Chapter of SigmaXi at Indiana University, on May 21 and 22, 1926. R. D. CARMICHAEL and HAROLD T. DAVIS spoke for the theory, the former dealing with the principles, the latter with the experimental verification; WILLIAM D. MACMILLAN and MASON E. HUFFORD spoke against it. G. S.

Whittaker, Edmund Taylor. The outstanding problems of relativity. From the presidential address to Section A (Mathematical and Physical Sciences) of the British Association delivered at Leeds on Sept. 5. *Nature*, 120, 368-371, 1927; also in *Science*, 66, 223-229, 1927. ISIS

23. — ASTRONOMY.

Drecker, Joseph. Die Theorie der Sonnenuhren. (*Die Geschichte der Zeitmessung und der Uhren* hrsg. von ERNST VON BASSERMANN-JORDAN, Bd. I, Lief. E) XI + 112 p., 14 pl. Berlin, WALTER DE GRUYTER, 1925. ISIS

This is a very elaborate account of the mathematical theory of sundials. Says the author : « Dem Charakter des Gesamtwerkes : ' Die Geschichte der Zeitmessung und der Uhren ' entsprechend wurde auch in diesem Teile, der die Mathematik der Sonnenuhr enthält, die geschichtliche Folge als Einteilungsprinzip gewählt. Ausgehend von dem durch VITRUVIUS und PTOLEMAEUS Überlieferten wird das Problem, die Linien der antiken Sonnenuhr zu konstruieren und zu berechnen, für alle Arten Aufnahmeflächen, die an erhaltenen Sonnenuhren vorkommen, gelöst. Die Gleichungen aller auftretenden Kurven werden abgeleitet, und die Kurven selbst durch Zeichnungen zur Anschauung gebracht. (Kapitel I-XII). Den Übergang zur modernen Sonnenuhr bildet die Sonnenuhr für italische und babylonische Stunden, die mit den antiken Stunden den beweglichen Anfang, mit den modernen die das ganze Jahr hindurch gleichbleibende Länge gemein haben. Von den modernen Sonnenuhren nehmen die tragbaren wegen ihres grossen Formenreichtums unser besonderes Interesse in Anspruch. Ausgeschlossen

aber mussten die Sonnenuhren bleiben, die weder in theoretischer noch in praktischer Hinsicht auf eigenartiger Grundlage beruhen, wie sie namentlich bei den Schriftstellern des 17. und 18. Jahrhunderts als müssige Spielereien in unzähligen Varietäten gefunden werden. Die beiden letzten Kapitel handeln über wahre und mittlere Zeit und über den Einfluss der atmosphärischen Refraktion. » It is splendidly published; in fact, too splendidly. It does not seem fair to place such a valuable book beyond the reach of those who may need it most. Let us hope that a popular edition will be published later. The author is well known to our readers because of his translation of PTOLEMY's Planisphere which appeared in *Isis*, 9, 255-78. Another part of this monumental work, SCHOY's Gnomonik der Araber was reviewed in *Isis*, 5, 534. G. S.

Feldhaus, Franz M. Zur Geschichte der Planetarien. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 89-91, 1927. ISIS

Lehmann-Nitsche, Robert. Das Sternbild des Bohrers. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 92-3, 1927. ISIS

Schoch, Karl. Planeten-Tafeln für Jedermann. Zur Berechnung der geozentrischen Oerter und Helligkeiten der grossen Planeten (und des Mondes) für den Zeitraum von 3400 v. Chr. bis 2600 n. Chr. ohne Anwendung der Logarithmen und trigonometrischen Funktionen bis auf ein Zehntel Grad unter besonderer Berücksichtigung der Babylonischen Astronomie. Mit über 100 leicht verständlichen, vollständig durchgeführten Beispielen für alle astronomischen Vorgänge von HAMMURABI bis zum Jahre 1927. Berlin-Pankow, LINSER-Verlag, 1927. ISIS

Thompson, J. Eric. A correlation of the Mayan and European calendars. 22 p. Chicago, Field Museum of Natural History (Publication 241; Anthropological Series, vol. 17, no. 1), 1927. ISIS

24. — PHYSICS

Boutaric, A. La chaleur et le froid. 284 p., 68 fig. Paris, ERNEST FLAMMARION, 1927. ISIS

Dans cet ouvrage qui rappellera à beaucoup de ses lecteurs une partie du cours de physique qu'ils avaient appris dans leur jeunesse, et qui intéressera les autres à la physique de la chaleur et du froid M. BOUTARIC a essayé et a réussi à expliquer sans aucun appareil mathématique comment les savants d'autrefois et d'aujourd'hui ont abordé les problèmes théoriques et pratiques soulevés par la thermométrie, la calorimétrie, les changements d'état physique des corps, les basses et hautes températures, la propagation de la chaleur, sa nature et le principe de CARNOT. Un dernier chapitre est consacré à une tentative de mise au point de la discussion récente et encore actuelle soulevée par l'apparente incompatibilité de l'énergétique et de l'atomistique. H. M.

Bray, M. E. J. Gheury de. Published values of the velocity of light. *Nature*, 120, 404-405, 1927. ISIS

Chwolson, O. D. Lehrbuch der Physik. 3. Aufl. Bd. I, t. 1 : Mechanik und Messmethoden. Vor der Drucklegung durchgesehen von GERHARD SCHMIDT. X + 401 p. Braunschweig, FRIEDR. VIEWEG & SOHN, 1926. ISIS

Crew, Henry. General Physics. 4th edition. XII + 674 pp. New York, The Macmillan Co., 1927. ISIS

This is an admirable statement of the main facts of modern physics. The author is very much interested in the history of physics, — witness, for example, his excellent translation of GALILEO's Dialogues concerning two new Sciences (New York, 1914; *Isis*, 3, 110) and many papers which may be found in our critical bibliographies by means of the indices. It is thus not surprising to find in this textbook a number of brief historical references. The work is divided as follows : mechanics (252 pp.), sound (42 pp.), heat (81 pp.), electricity and magnetism (145 pp.) light and electromagnetic spectrum (124 pp.), structure of matter (12 pp.); the last chapter including a summary of the latest views (at the time of writing!) on atomic structure. An appendix (3 pp.) deals with the historical development of the thermometer. An excellent book! G. S.

Eddington, Arthur Stanley. Stars and atoms. 127 p., 6 pl. New Haven, Yale University Press, 1927. ISIS

Engelmann, Max. Alte wissenschaftliche Instrumente. Sammlung ANT. W. M. MENSING in Amsterdam. 2 Teile, Text und Abbildungen. Amsterdam, 1924. ISIS

Fürst, Artur. Das elektrische Licht, von den Anfängen bis zur Gegenwart, nebst einer Geschichte der Beleuchtung. 222 p., 136 fig. München, ALBERT LANGEN, 1926. ISIS

Lorentz, Hendrik Antoon. Problems of modern physics : a course of lectures delivered in the California Institute of Technology. Edited by H. BATEMAN. VI + 312 p. Boston, GINN and Co., 1927. ISIS

Weve, H. Over brillenafbeeldingen in de plastische kunst. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 558-570, 6 fig., 1927. ISIS

Representations of spectacles.

Wien, W. u. Harms, F. (*edit.*). Handbuch der Experimentalphysik. Bd. I. Mess-Methoden und Mess-Technik, von LUDWIG HOLBORN; Technik des Experiments, von ERNST VON ANGERER. XX + 484 S., 246 Abb., 1 Taf. Bd. II. Mechanik der Massenpunkte und der

starken Körper von PHIL. ARTHUR HAAS. XIV + 356 S., 236 Abb. Akad. Verlaggesellsch., Leipzig, 1926. ISIS

Si l'on en juge par la liste des cinquante collaborateurs qu'ont su grouper autour d'eux W. WIEN et F. HARMS, et par l'ampleur des deux premiers volumes parus, où sont traitées les méthodes et la technique des mesures, la technique des manipulations auxquelles doit pouvoir se livrer couramment un physicien, la mécanique du point matériel, la mécanique des systèmes rigides (avec des compléments mathématiques sur la mécanique des solides), ce traité de physique formera une œuvre énorme, égale en ampleur au traité de BOUASSE, mais où chaque partie sera traitée par un spécialiste, alors que le physicien de Toulouse assume à peu près tout seul la tâche. Comme dans le BOUASSE (*Isis*, 7, 315, 325, 594,) si l'on en croit ces deux volumes qui corroborent l'annonce faite par les éditeurs dans leur très courte préface, la physique théorique ne sera envisagée que lorsqu'elle sera nécessaire à la compréhension des faits expérimentaux; quant aux renseignements historiques, ils sont relégués plus loin même qu'à l'arrière-plan. L. G.

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY.

Carbonelli, Giovanni. Sulle fonti storiche della chimica e dell'alchimia in Italia. Tratte dallo spoglio dei Manoscritti delle Bibliotheche con speciale riguardo ai codici 74 di Pavia e 1166 Laurenziano. Opera corredata di 242 riproduzioni fotografiche e due tavole fuori testo. XX + 210 p. Roma, Istit. naz. med. farmacologico, 1925. ISIS

Reviewed by K. SUDHOFF, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 261-262, 1927.

Catalogue des manuscrits alchimiques grecs, publié sous la direction de J. BIDEZ, F. CUMONT, A. DELATTE, J. L. HEIBERG, et O. LAGERCRANTZ. II : Les manuscrits italiens décrits par C. O. ZURETTI, avec la collaboration de O. LAGERCRANTZ, J. L. HEIBERG, I. HAMMER-JENSEN, D. BASSI et AE. MARTINI. VI + 368 pp. Bruxelles, LAMERTIN, 1927. ISIS

I gave a long account of this publication of the International Academic Union when parts I and III appeared (1924; *Isis*, 7, 507-511). It is not necessary to insist upon its importance; it is truly fundamental. The present volume contains descriptions of the two old Marciani (no. 299 by OTTO LAGERCRANTZ; no. 598 by J. L. HEIBERG; this covers not less than 37 pp.); of a large Laurentian MS. written in 1492 by ANTONIO DRANGANAS; of a Vatican MS. (no. 1174) and one Ottobonianus by I. HAMMER-JENSEN; the MSS of the Ambrosiana, of Venice and Bologna, of the Vatican and other Roman libraries are described by C. O. ZURETTI, and the Neapolitan by AE. MARTINI and D. BASSI. This is followed by a description of all of the Libri Koeranidum (Venice, Milan, Bologna, Florence) by C. O. ZURETTI (pp. 263-331), by a number of extracts edited by HEIBERG and ZURETTI (pp. 332-340), and by a comparative study of Parisinus 2327 with Marcianus 299 by LAGERCRANTZ, (These MSS are

independent and the former represents sometimes an older tradition), and last but not least by elaborate indices compiled by MARIE DELCOURT. The lion share of this volume was thus contributed by CARLO ORESTE ZURETTI, professor at the University of Milan. It is interesting to note that he is preparing an edition of the Vaticanus 1134, a MS. dated Reggio Calabriæ, 1376, which is perhaps as important as the old Marcianus 299 (Bessarion's MS.); see his preliminary note in LIPPMANN's Festschrift (pp. 55-77; *Isis*, 10, 135). G. S.

Haas, Arthur Erich. Atomic theory: an elementary exposition. Translated by T. VERSCHOYLE. XIV + 222 p. London, CONSTABLE, 1927. ISIS

Hedges, Ernest Sydney and **Meyers, J. E.** The problem of physico-chemical periodicity. With a foreword by F. G. DONNAN. 95 p., 2 pl. London, ARNOLD, 1926. ISIS

Reviewed by IRVINE MASSON, *Nature*, 119, 267-269, 1927.

Patterson, T. S. The late professor JOHN FERGUSON, (1837-1916). Reprinted, with some alterations, from the *Glasgow University Magazine*, Dec. 6, 1916, 16 p. ISIS

Ponsinet, Jules. Principes d'électrochimie. 216 p. *Collection Armand Colin*, Paris, COLIN, 1927. ISIS

Exposé clair des lois de l'électrochimie, fait en partant de l'hypothèse de la dissociation en ions des électrolytes. (Les réactions électrochimiques dans lesquelles le courant agit uniquement par ses effets calorifiques sont laissées de côté). Un chapitre est réservé aux concentrations en ions H, et à la mesure des P_H qui joue un rôle de plus en plus important en chimie et en biologie. Les applications ne sont qu'indiquées, comme illustration sommaire des lois. L. G.

Van Gelder, Arthur Pine and **Schlatter, Hugo.** History of the explosives industry in America. (Prepared from data collected by and published under the direction of the Institute of Makers of Explosives). With an introduction by CHARLES E. MUNROE. XXXVIII + 1132 p. New York, Columbia University Press, 1927. ISIS

Walden, Paul. Von der Iatrochemie zur « organischen Chemie ». Historisches über Entstehung und Namenbildung der « organischen Chemie ». *Z. f. angew. Chemie*, 40, 1-16, 1927. ISIS

Reviewed by PAUL DIERGART, *Mitt. zur Geschichte der Medizin*, 26, 182, 1927.

26. — TECHNOLOGY.

(*For mining, see* 32, *geology; for industrial chemistry*, 25, *chemistry. See also Arts and Crafts, under* 45.)

Alibaux, Henri. Les premières papeteries françaises. Paris, Les arts et le livre, 1926. ISIS

Bassermann-Jordan, Ernst von. Alte Uhren und ihre Meister. VIII + 179 p., 164 Abb., 8 farbige Tafeln, Bildniss. Leipzig, DIEBENER, 1926. ISIS

Blind, Adolphe. Les automates truqués. Genève, EGGIMANN, 1927. ISIS

Reviewed by F. M. FELDHAUS, *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 202, 1927.

Buckley, Wilfred. European glass; a brief outline of the history of glass making, with notes on various methods of glass decoration, illustrated by examples in the collection of the author. With a foreword by BERNARD RACKHAM, and with an essay on Dutch glass engravers by FERRAND HUDIG. XXXIV + 96 p., 104 pl. (Printed in Great Britain). Boston, HOUGHTON MIFFLIN, 1926. ISIS

Dick, Otto. Die Feile und ihre Entwicklungsgeschichte. 251 S., 278 Abb. Berlin, SPRINGER, 1925. ISIS

Feldhaus, Franz M. Ein Buch über die Leistungen der Techniker und Erfinder. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 13-22, 1927. ISIS

Feldhaus, Franz M. « Geschichte der Technik. » *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 1-5, 1927. ISIS

Announcing the creation of a society bearing that name, in Berlin, Febr. 18, 1927. « Der Zweck des Vereins ist die Verbreitung von Kenntnissen aus der Geschichte der Technik und Industrie wie auch Erwerb und Ausbau des von mir gesammelten Quellenmaterials zur Geschichte der Technik und Industrie. »

Feldhaus, Franz M. Die Sammlungen FELDHAUS und ihr neues Heim. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 6-10, 4 Abb., 1927. ISIS

Hartley, F. St. A. Electrical engineering. (Catalogue of the collections in the Science Museum, South Kensington, with descriptive and historical notes and illustrations.) 116 p., 14 plates. London, H. M. Stationery Office, 1927. (not seen). ISIS

Horwitz, Hugo Th. Systematik und Oekonomie bei technisch geschichtlicher Forschung. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 23-26, 1927. ISIS

Johannsen, Otto. Geschichte des Eisens. Zweite Auflage. VII + 248 p., 222 fig. Düsseldorf, Verlag Stahleisen, 1925. ISIS

Reviewed by H. Th. Horwitz, *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 199-201, 1927. First edition 1924 (*Isis*, 8, 617).

Leclerc, Emile et autres. Les transformations du papier et du carton. 160 pp. 270 x 220, nombr. illustr., Les publications Papyrus, Paris, 1926. ISIS

Cette belle publication, éditée par la revue *Papyrus* sur beau papier, et dont l'illustration est extrêmement soignée, est formée de courtes monographies écrites par des spécialistes du papier, de l'édition, de la reliure et du carton. J'y note surtout une causerie sur le papier, de Emile Leclerc; des considérations sur les principales sortes de papier d'édition, leur utilisation dans les divers procédés et leurs caractéristiques, de Jacques Crolard; des études de : Renée Dunan sur les éditions anciennes jusqu'au milieu du XVII^e^ s., avec des reproductions parfaitement venues; de Joseph Taupin sur la fabrication mécanique du livre; de Edmond Rocher sur l'art de la décoration dans la reliure moderne, et une note d'après F. Follot sur les origines et l'histoire du papier peint (les premiers essais faits en Europe remontent à la seconde moitié du XVI^e^ s.; la première fabrique est celle de Le François de Rouen, 1610). L. G.

Lefebvre des Noettes, Commandant, et **Bloch, Marc.** La force motrice animale et le rôle des inventions techniques. *Revue de Synthèse Historique*, 43, 83-91, 1927. ISIS

Luckiesh, Matthew. Contributions of science to the lighting art. *Science*, 65, 531-535, 1927. ISIS

Marsh, W. Lockwood. Aeronautical prints and drawings. XX + 36 p., 87 plates. London, Halton & Truscott Smith, 1924. ISIS

Reviewed by Hans W. Singer in *Deutsche Literaturzeitung*, 1116-1117, 1927.

Mori, Gustav. Das Schriftgiessergewerbe in Süddeutschland und den angrenzenden Ländern. Ein Abschnitt aus der Geschichte des deutschen Schriftgiesser-gewerbe. XX + 76 p., plates and portraits. Stuttgart, Schriftgiesserei Bauer & Co., 1924. ISIS

IV. BIOLOGICAL SCIENCES

(Knowledge of organic nature).

27. — BIOLOGY

(*Generalities*, « *Natural History* ».)

Bertalanfy, Ludwig von. Das Problem des Lebens. *Scientia*, 41, 265-74, 1927; trad. franç., *id.* suppl., 117-125. ISIS

La conception mécaniste de la vie ne suffit pas; insuffisantes aussi les expli-

cations vitalistes. La théorie biologique de RIGNANO seule permet actuellement d'ordonner les faits biologiques (p. 249). L. G.

Brachet, A. La vie créatice des formes (*Nouvelle collection scientifique*). 200 p., 29 fig. Paris, F. ALCAN, 1927. ISIS

Goldschmidt, Richard. Physiologische Theorie der Vererbung. VI + 247 p. Berlin, SPRINGER, 1927. ISIS

Reviewed by J. S. HUXLEY, *Nature*, 120, 109-111, 1927.

Jennings, Herbert Spencer. Vie et mort. Hérédité et évolution chez les organismes unicellulaires. Trad. de l'anglais par M. FRANÇOIS-PEREY. 276 p., 53 fig., FÉLIX ALCAN, Paris, 1927. ISIS

« Cet ouvrage n'est pas une étude de protozoologie, mais de génétique dans laquelle les protozoaires ont servi de matériel d'expérience, et dont les résultats ont été comparés à ceux que l'on connaissait pour les animaux supérieurs... Ce travail traite de l'hérédité, de la variation, de l'évolution au point de vue physiologique, et non historiquement. Il discute du présent et non de ce qui a pu se passer auparavant ». Le texte primitif (l'édition américaine est de 1920) a été revu par l'auteur, et mis au courant des travaux récents, en vue de cette traduction française. L. G.

Lillie, Ralph S. Physical indeterminism and vital action. *Science*, 66, 139-144, 1927. ISIS

MacLeod, Julius (1857-1919). The quantitative method in biology. (Publication of the University of Manchester, Biological series, no. 2). 2d ed., with a memoir of the author and a list of his scientific writings. XXIII + 228 p., illust. Manchester, University Press, 1926. ISIS

Meyer, Adolf. Logik der Morphologie : im Rahmen einer Logik der gesamten Biologie. VII + 290 p. Berlin, JULIUS SPRINGER, 1926. ISIS

Mitchell, P. Chalmers. Logic and law in biology. *Nature*, 119, 748-750, 1927. ISIS

HUXLEY memorial lecture delivered at the Imperial College of Science and Technology, South Kensington, May 4, 1927.

Patten, Charles Joseph. The memory factor in biology : a sketch of the unity of life. XIII + 175 p. London, BAILLIÈRE, TINDALL and COX, 1926. ISIS

Reviewed by E. S. R. in *Nature*, 119, 741, 1927.

Pearl, Raymond. The biology of population growth. XIV + 260 p. London, WILLIAMS and NORGATE, 1926. ISIS

Reviewed by A. B. HILL in *Nature*, 120, 394-96, 1927.

Przibram, Hans. Die anorganischen Grenzgebiete der Biologie (insbesondere der Kristallvergleich). (*Sammlung Borntraeger*, Band 10.) 240 p. Berlin, Gebrüder BORNTRAEGER, 1926. ISIS

Reviewed by E. W. M. in *Nature*, 119, 738-740, 1927.

Rignano, Eugenio. Qu'est-ce que la vie ? Nouveaux essais de synthèse biologique. 208 p. Paris, ALCAN, 1926. ISIS

L'auteur a groupé sous ce titre ses études parues dans *Scientia*, t. 38 et 39 (1925 et 1926), dont j'ai précédemment indiqué le contenu (*Isis*, 9, 197). Seul est nouveau le chapitre de conclusion intitulé « la place de l'homme dans l'univers et la morale nouvelle de l'harmonie de la vie. » L. G.

Rolleston, Sir Humphry. Concerning Old Age. (Discourse delivered at the Royal Institution, May 13, 1927). Supplement to *Nature*, 120, 2-12, 1927. ISIS

Stiles, Walter. Modern views of the mechanism of carbon assimilation. *Scientia*, 41, 117-126, 1927; trad. franç., *id.*, suppl. 62-70. ISIS

Varigny, Henry de. La mort et la biologie : la mort devant la biologie, les organismes immortels, l'antiquité de la maladie, vieillesse et rajeunissement. 312 p. Paris, FÉLIX ALCAN, 1926. ISIS

Ce volume réunit une série d'essais sur la mort, pour lesquels l'auteur s'est vu attribuer en 1926 le prix Binoux (*Isis*, 8, 161-3, 725; 9, 370-2) pour l'histoire et la philosophie des sciences. D'histoire des sciences, il n'en est pas question dans ce livre; de philosophie des sciences, pas beaucoup plus. Chacun des chapitres, d'ailleurs agréables à lire, fait l'effet d'un bon article de vulgarisation pour une revue destinée au grand public. L. G.

Volterra, Vito. Una teoria matematica sulla lotta per l'esistenza. *Scientia*, 41, 85-102, 1927; trad. franç., *id.* suppl., 33-48. ISIS

Exposé très succint des travaux de l'auteur.

Weber, Friedl. Neue Wege der Protoplasma-Forschung. *Scientia*, 40, 367-378, 1926; trad. franç., *id.*, suppl., 130-139. ISIS

28. — BOTANY

(*Agronomy, Phytopathology, Palaeobotany.*)

Bidwell, Percy Wells and **Falconer, John I.** History of agriculture in the northern United States 1620-1860. XII + 512 p., 114 fig., 86 tables. Washington, D. C., Carnegie Institution, 1925. ISIS

The point of view of this compilation is almost exclusively economic. However the historian of botany may have to refer to it to obtain information on the plants cultivated in America. Of course it deals not only with agriculture stricto sensu but with livestock and husbandry in general. It is divided in

four parts : 1. Agriculture in the earliest settlements (unfortunately very short, 62 p.); 2. Rural economy in the eighteenth century (76 p.); 3. Expansion and progress, 1800-40 (110 p.); 4. Northern agriculture, 1840-60. The period of transformation (195 p.). This will interest also the historian of technology, because of the attention paid to the development of agricultural machinery. This study is completed by a classified and critical bibliography, an alphabetical list of the works quoted (725 in number), miscellaneous statistics and an index. There are 114 figures most of which are economic maps. G. S.

Bose, Sir **Jagadis Chunder**. Plant autographs and their revelations. XIV + 231 p. London, Longmans, GREEN, 1927. ISIS

Reviewed by C. J. PATTEN in *Nature*, 110, 919-920, 1927.

Cohen, Hendrik. Bijdrage tot de geschiedenis der geneeskruidcultuur in Nederland. Proefschrift. XXIII + 251 p., 20 pl. Rotterdam, BRUSSE, 1927. ISIS

Reviewed by M. A. VAN ANDEL, *Bijdragen tot de geschiedenis der geneeskunde*, 7, 375-376, 1927.

Darmstaedter, Ernst. Eisenhärtung mit Pflanzen. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 163-169, 1927. ISIS

Goblet d'Alviella, Comte. Histoire des bois et forêts en Belgique. Des origines à la fin du régime autrichien. 3 vol. 982 p., 36 pl. Paris, PAUL LECHEVALIER, 1927. ISIS

Reviewed in *Revue générale des Sciences*, 38, 483, 1927.

Guitard, E. H. Les dictionnaires et les traités de botanique. *Bull. soc. hist. de la pharmacie*, 333-344, 4 pl., déc. 1926. ISIS

Guide bibliographique sommaire.

Hahn, Eduard. Die Pflanze als Begleiter der Menschheit. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 54-61, 1927. ISIS

General views on the dawn of agriculture.

Kroeber, Ludwig. « Kräuterbücher » in alter und neuer Zeit. Festschrift für A. TSCHIRSCH. S. 108-120. Leipzig, CHR. H. TAUCHNITZ, 1925. ISIS

Peake, Harold J. E. The beginnings and the early spread of agriculture. *Nature*, 119, 894-896, 1927. ISIS

Rohde, Eleanour Sinclair. Garden-craft in the Bible and other essays. Many illustrations. London, HERBERT JENKINS, 1927. ISIS

Spoehr, Herman Augustus. Photosynthesis. (*American Chemical Society Monograph Series*, No. 29.) pp. 393. New York, The Chemical Catalog Co., 1926. ISIS

Reviewed in *Nature*, 119, 808-809, 1927.

Tupling, George Henry. The economic history of Rossendale. Maps, plans and table. Manchester, University Press, 1927. ISIS

Whitney, Milton. Soil and civilisation : a modern concept of the soil and the historical development of agriculture. (Library of Modern Sciences.) x + 278 p., 5 pl. London, CHAPMAN and HALL, 1926. ISIS

Reviewed by W. E. B. in *Nature*, 120, 436-7, 1927.

Wilson, Ernest Henry. Plant hunting. Two volumes; with 128 illustrations mostly from photographs taken by the author. Boston, Mass., STRATFORD Co., 1927. ISIS

29. — ZOOLOGY.

Ash, Edward C. Dogs : their history and development. 2 vols. With an introduction by the Duchess of Newcastle. vol. 1: XVIII + 384 p., 108 pl. Vol. 2 : XVI + p. 385-778, pls. 109-160. London, ERNEST BENN, 1927. ISIS

Bresslau, E., and **Ziegler, H. E.** Zoologisches Wörterbuch : Erklärung der zoologischen Fachausdrücke; zum Gebrauch bein Studium zoologischer, anatomischer, entwicklungsgeschichtlicher und naturphilosophischer Werke. Revidiert und herausgegeben von H. E. ZIEGLER und E. BRESSLAU. Dritte vermehrte und verbesserte Auflage. VIII + 786 p. Jena, GUSTAV FISCHER, 1927. ISIS

Reviewed in *Nature*, 119, 632, 1927.

Garbini, Adriano. Antroponimie ed Omonimie nel campo della zoologia popolare. Parte II : Omonimie. Vol. I. II. (Accad. di Agricoltura, Scienze e Lettere. Vol. fuori serie.) 1598 p. Verona, La Tipografica Veronese, 1925. ISIS

Reviewed by W. MEYER-LÜBKE, *Deutsche Literaturzeitung*, 502-503, 1927.

Hirsch-Schweigger, Erwin. Zoologisches Wörterbuch. (Veit's Sammlung Wissenschaftlicher Wörterbücher). VIII + 628 p., 477 fig. Berlin, WALTER DE GRUYTER, 1925. ISIS

Horwitz, Hugo Th. Über den Gebrauch von Werkzeugen im Tierreich. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 26-29, 1927. ISIS

Jenkins, James Travis. The herring and the herring fisheries. London, KING, 1927. ISIS

Kraemer, Hermann. Der Artbegriff in Anwendung auf die Haustiere. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 62-71, 1927. ISIS

Maeterlinck, Maurice. La vie des termites. 219 p., 1 fig. Paris, FASQUELLE, 1926. ISIS

Étude bien documentée qui continue en quelque sorte l'enquête commencée dans « la vie des abeilles » il y a tant d'années. Dans les derniers chapitres : Les destinées, l'instinct et l'intelligence, l'auteur essaye d'en dégager les leçons, mais il n'aboutit qu'à reconnaitre un insondable mystère. « Ma conclusion c'est qu'il faut apprendre à accepter notre ignorance des choses essentielles, et devenir plus humble. C'est ce que font les savants, mais les philosophes l'oublient trop souvent. » G. S.

Pavlovskii, E. N. Gifttiere und ihre Giftigkeit. XVI + 516 p., 176 illustrations. Jena, GUSTAV FISCHER, 1927. ISIS

Rudy, Hermann. Die Wanderheuschrecke, Locusta migratoria L. phasa migratoria L. et phasa danica L. Beiträge zu einer Monographie. *Badische Blätter für Schädlingsbekämpfung*. 34 S., 3 Taf., Freiburg i. Br., 1925. ISIS

V. SCIENCES OF THE EARTH

(implying knowledge of both organic and inorganic nature.)

30. — GEODESY.

Bowie, William. Isostasy. XV + 275 p., 39 illustrations. New York, E. P. DUTTON, 1927. (five dollars). ISIS

This general review of isostasy and connected problems hardly needs commendation. The author is one of the world authorities on the subject. Since 1909 he has continued the work of JOHN F. HAYFORD in the service of the U. S. Coast and Geodetic Survey. Leaving aside vague ideas, or even more definite suggestions, such as those made by BABBAGE and HERSCHEL at the beginning of the last century, we may say that this new branch of science (one connecting geology and geodesy) was born in 1855 (G. B. AIRY, *Philos. Trans.*, 145, 101). AIRY was followed by J. H. PRATT. The two fundamental isostatic theories are called after these two men : PRATT's theory postulates that the earth's crust extends to a certain depth below sea level, with varying densities of crustal material under elevations and depressions; on the contrary AIRY's theory postulates that the crustal matter has uniform density with varying thicknesses. The author is convinced that PRATT's view is the right one; but AIRY's view is not entirely abandoned, e.g. WEGENER favors it. The American C. E. DUTTON read in Washington, as early as 1871, a paper

on the causes of regional elevations and subsidence, which was truly prophetic. He must be counted one of the founders of isostasy. HAYFORD's and BOWIE's investigations were the first to give a quantitative proof of the new theory; their conclusions based upon American evidence were admirably confirmed by SIDNEY BURRARD, using Hindu material. BOWIE's survey is divided as follows : 1. The development of the isostatic theory; 2. Quantitative test of isostatic theory; 3. Assumptions underlying computations of isostatic effect; 4. Isostatic condition of earth's crust under various classes of terrain; 5. Some geodetic and geophysical deductions from the proof of isostasy; 6. Some phases of isostatic adjustment; 7. The influence of isostasy on geological deductions; 8. Processes involved in crustal and subcrustal movements; 9. Proposed theory, in harmony with isostasy, to account for major changes in the elevation of the earth's surface. G. S.

31. — GEOGRAPHY and OCEANOGRAPHY.

Chubb, Thomas. The printed maps in the atlases of Great Britain and Ireland. A bibliography, 1597-1870. With an introduction by F. P. SPRENT, and biographical notes on the map makers, engravers, and publishers. 479 p. London, Homeland Association, 1927. ISIS

Dreyer, A. Bücherverzeichnis der Alpenvereinsbücherei mit Verfasser- und Bergnamenverzeichnis. Hrsg. vom Hauptausschuss des deutschen und österreichischen Alpenvereins und vom Verein der Freunde der Alpenvereinsbücherei. XVI + 1358 Sp. München, K. LINDAUER, 1927. ISIS

Reviewed by EUGEN WEBER, *Deutsche Literaturzeitung*, 1622-23, 1927.

Fite, Emerson D. and **Freeman, Archibald.** A book of old maps, delineating American history from the earliest days down to the close of the revolutionary war. XVI + 299 p. Cambridge, Mass., Harvard University Press, 1927. ISIS

Fitzgerald, Walter. The historical geography of early Ireland. With an introduction by PERCY M. ROXBY. (*The Geographical Teacher*, Supplement No. 1.) VII + 100 p., illustrated. London, GEORGE PHILIP, 1926. ISIS

Hettner, Alfred. Die Geographie : ihre Geschichte, ihr Wesen und ihre Methoden. VIII + 463 p. Breslau, FERDINAND HIRT, 1927. ISIS

Martin, Lawrence. Noteworthy maps with charts, views and atlases. Accessions for the fiscal year ending June 30, 1926. (Library of Congress, division of maps.) 28 p. Washington, D. C., Government printing office, 1927. ISIS

Rouch, Jules. Les régions polaires. (*Nouvelle Collection scientifique.*) Paris, Alcan, 1927. ISIS

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING.

(For palaeobotany, palaeozoology and palaeoanthropology, see respectively 28. *botany*, 29. *zoology, and* 39. *prehistory.)*

Allen, R. C. and **Martin, Helen M.** A brief history of the geological and biological survey of Michigan. 1837 to 1872 by R. C. ALLEN; 1872 to 1920 by HELEN M. MARTIN. *Michigan Hist. Mag.*, 6, 675-750, 3 portraits, 1922. ISIS

Davison, Charles. The Founders of Seismology. XIV + 240 p. Cambridge, Universtiy Press, 1927. ISIS

This account of the history of seismology, by one of the most expert students of the subject, is very elaborate and apparently very accurate. It is divided as follows : 1. Before MICHELL : JOHN BEVIS, ELIE BERTRAND ; 2. JOHN MICHELL ; 3. From MICHELL to PERREY ; 4. ALEXIS PERREY ; 5. ROBERT MALLET and his successors ; 6. The study of earthquakes in Italy ; 7. The study of earthquakes in Central Europe ; 8. The study of earthquakes in the United States ; 9. FERNAND DE MONTESSUS DE BALLORE ; 10. JOHN MILNE ; 11. FUSAKICHI OMORI.

The biographies of the main protagonists are brief but sufficient, and the analysis of their contributions is very clear and well ordered, with references to the papers wherein they occur. Our only regret is the absence of a few portraits ; this would not have increased considerably the cost of the book and would have made it much more attractive. A previous historical study by the same author, A History of British Earthquakes, Cambridge, 1924, was reviewed in *Isis*, 8, 628. G. S.

Gattefossé, Jean et **Roux, Claudius.** Bibliographie de l'Atlantide et des questions connexes, (géographie, ethnographie et migrations anciennes. Atlantique et Méditerranée, Afrique et Amérique, fixité ou dérive des continents, déluges, traditions, etc.). 111 p., avec 15 planches de cartes et croquis. Lyon, BOSC et RIOU, 1926. ISIS

Groth, Paul. Entwicklungsgeschichte der mineralogischen Wissenschaften. IV + 262 S., 5 Textfig. Berlin, SPRINGER, 1926. ISIS

Reviewed by ARRIEN JOHNSEN, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 367-368, 1927.

Perkins, George Henry. History and summary of geological work in Vermont, 1810-1923. Vermont, State Geologist, 13th Report (1921-1922), 1-70, 1923. ISIS

Wegener, Alfred. Die geophysikalischen Grundlagen der Theorie der

Kontinentenverschiebung. *Scientia*, 41, 103-116, 1927; trad. franç., *id.*, suppl., 49-61. ISIS

Examen des preuves apportées par la géophysique à l'apui de la théorie de la dérive des continents (Die Entstehung der Kontinente und Ozeane, 3e Aufl., 1922; *Isis*, 6, 223), par les faits d'isostasie, les connaissances sur la nature du sol de la haute mer, ce que l'on sait de la viscosité de la terre, et ce que l'on peut attendre de déterminations précises et répétées de la longitude du Groenland. L. G.

33. — METEOROLOGY, CLIMATOLOGY and TERRESTRIAL PHYSICS.

Shaw, Sir **Napier**. Manual of meteorology. Vol. I : Meteorology in history. With the assistance of ELAINE AUSTIN. XX + 339 p., 18 pl. Cambridge, University Press, 1926. ISIS

Reviewed by W. H. DINES, *Nature*, 119, 915-17, 1927.

VI. ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present).

34. — ANATOMY.

Capparoni, Pietro. La persistenza delle forme degli antichi « donaria » anatomici negli « ex voto » moderni. *Bolletino dell'Istituto storico italiano dell' arte sanitaria*, p. 39-57, 38 fig., Roma, 1927. ISIS

Lint, J. G. de. Atlas of the history of medicine. I. Anatomy. With a foreword by CHARLES SINGER. 96 p. New York, PAUL B. HOEBER, 1926. ISIS

Chronological series of 199 pictures, with supplementary notes, illustrating the development of anatomy from Babylonian times to HUGO DE VRIES. Naturally richest in Dutch material. In a picture book history of this sort, caution is required in arranging the size of the illustrations, so that the uninitiated will not get a wrong prospective. One might get an entirely erroneous idea of the relative importance of the contributors to the science, when one finds a full page devoted to CORNELIUS VAN 'S-GRAVEZANDE (1631-1691), who contributed practically nothing to the subject, and only a quarter page to MARCELLO MALPIGHI (1628-1694) who was one of the greatest of the microscopists. It is surprising in view of SPIELMANN's critique to note the doubtful portrait of VESALIUS first described by DANIELS. Is there no pictorial representation of EUSTACHIUS extant ? The expert would have appreciated mention of the source of many of the pictures. Dr. SINGER's Foreword includes some interesting philosophical considerations. The book is marred by a profusion of irritating typographical errors, not to be expected from HOEBER, nd by the lack of an index. C. D. L .

Masson, Louis. Les papes et la dissection. *Aesculape*, 121-4, mai, 1927. ISIS

Commentaire approbatif sur un travail de G. MARTINOTTI, dont le titre n'est pas donné. Contrairement à l'opinion maintes fois exprimée, l'église n'aurait jamais entravé la dissection des cadavres humains; la bulle de BONIFACE VIII (1299) n'aurait eu d'autre but que de régulariser les moyens de se procurer des cadavres. L. G.

35. — PHYSICAL ANTHROPOLOGY.

(*Anthropometry and races of man*).

Haddon, Alfred Cort. Les races humaines et leur répartition géographique. Traduit par A. VAN GENNEP. XV + 327 p., 12 pl. Paris, FÉLIX ALCAN, 1927. ISIS

English editions, London, MILNER, 1909; New York, MACMILLAN, 1925.

Nijessen, D. J. H. De nederlandsche arts als anthropoloog. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 602-613, portraits, 1927. ISIS

Pitt-Rivers, George Henry Lane-Fox. The clash of culture and the contact of races : an anthropological and psychological study of the laws of racial adaptability, with special reference to the depopulation of the Pacific and the government of subject races. XIV + 312 p. London, GEORGE ROUTLEDGE, 1927. ISIS

Roberts, Stephen Henry. Population problems of the Pacific. XX + 411 p. London, ROUTLEDGE, 1927. ISIS

Schmidt, Max (1874-). The primitive races of mankind, a study in ethnology. Translated by ALEXANDER K. DALLAS. 360 p., 80 pls., maps. London, HARRAP, 1926. ISIS

Taylor, Griffith. Environment and race. A study of the evolution, migration, settlement and status of the races of man. 372 p., 6 pl., 93 fig. in text. New York, Oxford University Press (American Branch), 1927. ISIS

36. — PHYSIOLOGY.

(*human and comparative*).

Fulton, John Farquhar, jr. Muscular contraction and the reflex control of movement. XV + 644 p., illus. Baltimore, WILLIAM and WILKINS, 1926. ISIS

Reviewed in *Nature*, 120, 437-8, 1927.

37. — PSYCHOLOGY.

(*human and comparative*).

Bertrand-Barraud, Daniel. De la nature affective de la conscience. 156 p. Paris, J. VRIN, 1927. ISIS

Ce petit volume, formé de « six leçons de psychologie concrète » professées à la faculté des lettres de Bordeaux en 1925-6 reprend et complète les idées antérieurement exposées par l'auteur. Les valeurs affectives et l'exercice discursif de la pensée, essai d'empirisme psychologique radical; Des bases d'un empirisme psychologique radical (*Isis*, 10, 290). L. G.

Geley, Gustave. Clairvoyance and materialisation; a record of experiments. Translated by STANLEY DE BRATH. XVI + 401 p., 51 pl. London, FISHER UNWIN, 1927. ISIS

Reviewed in *Nature*, 120, 111-112, 1927.

Leyacker, Josef. Zur Entstehung der Lehre von den Hirnventrikeln als Sitz psychischer Vermögen. *Archiv für Geschichte der Medizin*, 19, 253-286, 1927. ISIS

Rignano, Eugenio. Le congrès international de psychologie de Groningue. *Scientia*, 41, 127-150, 1927. ISIS

Note critique sur les travaux présentés à ce VIII[e] congrès, tenu à Groningue en 1926, congrès vraiment international, celui-ci. L. G.

Roback, A. A. A bibliography of character and personality. 340 p. Cambridge, Mass., Sci-art publishers, 1927. ISIS

This bibliography, containing more than three thousand titles, has the great advantage of having been prepared, not by a bibliographer, but by a student of the subject; i.e. not merely from the outside, but from the inside. Indeed ROBACK's own book, Psychology of character (London, KEGAN PAUL, 1927) is one of the main contributions to this important branch of psychology. The bibliography is arranged alphabetically by authors, but is followed by a classification of titles according to point of view, by lists of periodicals and institutions, and by a chronological appendix. I only regret the paucity of critical notes which the author could have easily added at least to some of the titles. As it is, this bibliography is essentially superior to the one published by GRACE E. MANSON in the Reprint and Circular series of the National Research Council (60 p., Washington, D. C., 1926). G. S.

38. — ARCHAEOLOGY

(*Generalities, methods*).

Macalister, Robert Alexander Stewart. A century of excavation in Palestine. 335 p., 36 pl., ill., London, Religious Tract Society, 1926. ISIS

39. — PREHISTORY.

Ebert, Max (*editor*). Vorgeschichtliches Jahrbuch für die Gesellschaft für vorgeschichtliche Forschung. Band II : Bibliographie des Jahres 1925 mit sechs Tafeln und einer Abbildung im Text. 344 p. Berlin, WALTER DE GRUYTER, 1926. ISIS

Reviewed by GEORGE GRANT MCCURDY, in *Science*, 65, 527, 1927.

Evans, William. The Meini Hirion and sarns of Anglesey. (Considered in relation to the early Hundred System). 53 p. Author : Pen-y-Bont, Red Wharf Bay, Anglesey. ISIS

Jones, Neville. The stone age in Rhodesia. XIV + 120 p., 22 pl. London, Oxford, University Press, 1926. ISIS

Reviewed by HENRY BALFOUR, *Nature*, 119, 226-228. 1927.

Merhart, Gero von. Bronzezeit am Jenissei : ein Beitrag zur Urgeschichte Sibiriens. 190 p., 12 pl. Wien, ANTON SCHROLL, 1926. ISIS

Reviewed by M. C. BURKITT in *Nature*, 119, 775-776, 1927.

Mötefindt, Hugo. Ein buntes Gewebe aus dem prähistorischen Salzbergwerk auf dem Dürrnberg bei Hallein. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 191-193, 1927. ISIS

40. — ETHNOLOGY.

(*Primitive and popular science*).

Bakker, C. Volksgeneeskundige aanteekeningen in en om Broek in Waterland verzameld. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 356-369, 1927. ISIS

Fettweis, E. Das Rechnen der Naturvölker. IV + 96 p., map. Leipzig, B. G. TEUBNER, 1927. ISIS

Dies ist die erste derartige Arbeit, die auf grund aller ethnographischen und linguistischen Quellen das vorgesetzte Thema untersucht. Der Verfasser hat eine Literatur von etwa 240 Einzelschriften angegeben, die er in den Fuzsnoten mit Seitenzahlen zitiert. Die Schrift hat folgende Kapitel : 1. Ansatzmöglichkeiten für die Entwicklung der Rechenkunst; 2. Rechnen mit und ohne Anschauungsmittel, Ziffernsysteme; 3. Zählgruppen und Zählreihen; 4. Zählgesten; 5. Ausführung längerer Rechnungen, Bruchrechnung; 6. Zahlworte, Zahlwortreihen; 7. Der Sinn der Zahlworte; 8. Rechenunterricht usw. Man lernt aber aus der Schrift nicht nur eine Menge bisher völlig verstreut gewesener Einzelheiten, sondern kann auch mehrere allgemeine Züge daraus entnehmen. Z. B. den, dasz die Völker meist deswegen nicht weiter kommen in ihrem Zahlbereich oder in ihrer Rechenfertigkeit, weil

dazu kein Bedürfnis vorliegt. Man erfährt, dasz es auch mystische Hemmungen gibt. Man erkennt, dasz primitive Völker jedes unpraktische Rechenbeispiel als unmöglich oder unverständlich ablehnen. Man sieht dasz Zahlwörter fehlen können, während die Begriffe der Zahlen und die Fertigkeit mit ihnen zu rechnen, doch vorhanden ist. Es gibt alle möglichen Zahlensysteme vom 2er-System bis zum 40er-System, mit vielflätigen Unregelmäszigkeiten. Sehr bemerkenswert sind auch die Folgerungen, die der Verfasser für den modernen Rechenunterricht aus diesen Erfahrungen zieht. Sie stimmen mit dem, was die heutige Psychologie sagt, durchaus überein.

H. W.

Folmer, H. R. Volksgebruiken in Zeeland bij geboorte en kraambed. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 377-383, 1927. ISIS

Imbelloni, J. La Esfinge Indiana : antiguos y nuevos aspectos del problema de los origenes americanos. 399 p., 19 pl. Buenos Aires : Libreria El Ateneo, 1926. ISIS

Reviewed by G. ELLIOT SMITH, *Nature*, 119, 3-5, 1927.

Karsten, Rafael. The civilization of the South American Indians : with special reference to magic and religion. (*The History of Civilization Series*). XXXII + 540 p. London, KEGAN PAUL, 1926. ISIS

Reviewed in *Nature*, 119, 921, 1927.

Leroy, Olivier. La raison primitive. Essai de réfutation de la théorie du prélogisme. 316 p., 23 illus., dont 15 pl. hors-texte. Paris, GEUTHNER, 1927 (60 frs.) ISIS

Œuvre de polémique contre les ouvrages de LÉVY-BRUHL sur la mentalité primitive, ouvrages bien connus de nos lecteurs (*Isis*, 5 467; 9, 482). LÉVY-BRUHL s'est efforcé d'établir sa théorie du prélogisme inductivement, à l'aide d'un grand nombre d'exemples. LEROY procède de même pour détruire cette théorie. Je dois avouer que la théorie du prélogisme me déplait en ce qu'elle crée dans l'humanité une discontinuité qui me parait artificielle. Je n'ai guère eu l'occasion d'observer beaucoup de sauvages, mais j'ai eu de très nombreuses occasions d'observer des hommes de science, c'est-à-dire des être humains dont les fonctions mentales sont les plus disciplinées et dont la pensée est censée être aussi logique que possible. Or j'ai été souvent affligé de constater que ces hommes de science, si éminents qu'ils soient, sont fort souvent, trop souvent, illogiques, antilogiques, alogiques ou prélogiques. Quand les passions sont en jeu, les gens les plus civilisés se fichent du principe de contradiction avec autant de désinvolture que les sauvages. D'autre part LEROY nous prouve que ceux ci font souvent preuve d'un esprit logique fort remarquable. Donc je ne suis pas tenté de croire avec LÉVY-BRUHL que la pensée primitive soit essentiellement différente de la notre. Je crois qu'il n'y a là qu'une différence de degré. Je recommande vivement aux lecteurs de LÉVY-BRUHL de lire LEROY et vice versa. Pour un autre ouvrage de LEROY, voir *Isis*, 8, 637.

G. S.

Lévy-Bruhl, Lucien. How natives think (Les fonctions mentales dans

les sociétés inférieures). Authorised translation by LILIAN S. CLARE. 392 p. London, GEORGE ALLEN, 1926. ISIS

Reviewed in *Nature*, 119, 700-701, 1927.

Malinowski, Bronislaw. Sex and repression in savage society. (*International Library of Psychology, Philosophy and Scientific Method*). XV + 285 p. London, KEGAN PAUL, 1927. ISIS

Mason, Gregory. Silver cities of Yucatan. With a preface by H. J. SPINDEN. Illustrated with drawings by Dr. SPINDEN and with photographs; 32 illus., 1 map. XVII + 340 p. London, PUTNAM, 1927. ISIS

Moodie, Roy L. Injuries to the head among the precolumbian Peruvians. (Studies in Paleopathology XXI). *Annals of Medical History*, 9, 277-307, 22 fig. 1927. ISIS

Netolitzky, Fritz. Volkstümliche Blutstillungsmittel und ihre Deutung. *Medizinisch-Pharmazeutische Technik*. Monatsbeiheft zu « Biologischer Heilkunst », Februar, 1927, 5 S. Radeburg (Bez. Drezden), 1927. ISIS

Reviewed by MARZELL, *Mitt. zur Geschichte der Medizin*, 26, 277, 1927.

Puckle, Bertram S. Funeral customs : their origin and development. 283 p., illus. London, T. W. LAURIE, 1926. ISIS

Schmidt, Wilhelm, und **Koppers, Wilhelm.** Völker und Kulturen. I. Teil : Gesellschaft und Wirtschaft der Völker. (Der Mensch aller Zeiten, Natur und Kultur der Völker der Erde, Band 3.) XII + 740 p., 1 map, 30 col. plates, 551 textfigures. Regensburg, JOSEF HABBEL, 1924. ISIS

Reviewed by R. THURNWALD, *Deutsche Literaturzeitung*, 1906-1916, 1927.

Wright, Jonathan. The medicine of primitive man. *Medical Life*, 34, 41-46, 87-96, 362-408, 1927. ISIS

41. — SUPERSTITION and OCCULTISM.

Fournier d'Albe, Edmund Edward. Telekinesis and materialisation. *Nature*, 120, 446-448, 1927. ISIS

inckowstroem, Graf Carl von. Zur Geschichte der Pseudotelepathie. *Zeitschrift für kritischen Okkultismus*, 3, 9-20, Okt. 1927.

Mager, Henry. Les sourciers et leurs procédés. Troisième édition complètement refondue. XX + 352 p. Paris, DUNOD, 1926. ISIS

First edition 1913; second, 1923 (*Isis*, 6, 248).

Strauss, Heinz Artur. Astrologie. Grundsätzliche Betrachtungen. 76 p. München, KURT WOLFF, 1927. ISIS

Reviewed by K. SUDHOFF, *Mitt. zur Geschichte der Medizin und der Naturwissenschaften*, 26, 253-254, 1927.

Summers, Montague. The history of witchcraft and demonology. London, KEGAN PAUL, 1927. ISIS

Summers, Montague. The geography of witchcraft. London, KEGAN PAUL, 1927. ISIS

42. — ECONOMICS.

(*Economic doctrines and history, Commerce, Transportation and Communications*).

Business Historical Society, Boston, Massachusetts. Incorporated late in 1925. Pamphlet of 16 p. explaining aims, and containing list of members. George F. Baker Library, Soldiers Field. Boston, August 1, 1927. ISIS

Helfferich, Karl (1872-1924). Money. Translated from the German by LOUIS INFIELD, and edited with an introduction by T. E. GREGORY. Two volumes. London, BENN, 1927. ISIS

Volckmann, Erwin. Germanischer Handel und Verkehr. Synoptische Handelsgeschichte der germanischen Völker (von der Urzeit bis, 1600). VIII + 544 p., 10 fig., maps. Würzburg, MEMMINGER, 1925. ISIS

Reviewed by HERMANN BÄCHTOLD, *Deutsche Literaturzeitung*, 1470-71 1927.

43. — SOCIOLOGY, JURISPRUDENCE and POSITIVE POLITY.

Briffault, Robert. The mothers. A study of the origins of sentiments and institutions. 3 vols. Vol. 1, XIX + 781 p.; vol. 2, XX + 789 p.; vol. 3, XV + 841 p. London, ALLEN and UNWIN, 1927. ISIS

Chénon, Emile. Histoire générale du droit français public et privé des origines à 1815. Vol I. Paris, L. TENIN, 1926. ISIS

Heijnsbergen, P. van. De pijnbank in de Nederlanden. Groningen, P. NOORDHOFF, 1926. ISIS

Holdsworth, William Searle. A history of English law. Volume 9, XXXII + 457 p. London, METHUEN, 1927. ISIS

Kübler, Bernhard. Geschichte des römischen Rechts. Ein Lehrbuch. X + 459 p. Leipzig, A. Deichertsche Verlagsbuchh., DR. W. SCHÖLL, 1925. ISIS

Reviewed by J. BINDER in *Deutsche Literaturzeitung*, 1366-1373, 1927.

Malinowski, Bronislaw. The father in primitive psychology. 93 p. London, KEGAN PAUL, 1927. ISIS

44. — HISTORY of CIVILIZATION.

(*General History, Historical methods, Biography and Chronology.*)

Breasted, James Henry and **Robinson, James Harvey.** The human adventure. (1) The conquest of civilization, by J. H. BREASTED. XXV + 717 p., 50 plates, 17 maps. (2) The ordeal of civilization : a sketch of the development and world-wide diffusion of our present-day institutions and ideas, by J. H. ROBINSON. XII + 769 p., 59 plates, 12 maps. New York, HARPER and BROS., 1926. ISIS

Reviewed by F. S. MARVIN in *Nature*, 119, 591-593, 1927.

Clark, George Norman. Historical reviewing. Essays in history presented to REGINALD LANE POOLE, p. 115-126, Oxford, 1927. ISIS

Edwards, Lyford Paterson. The natural history of revolution. Chicago University Press, 1927. ISIS

Ehrencron-Müller, Holger. Forfatterlexikon omfattende Danmark, Norge og Island indtil 1814. Bind I-IV. 544 S.; 489 S.; 514 S.; 495 S. Kopenhagen, H. ASCHEHOUG, 1924-27. ISIS

Reviewed by GUSTAV NECKEL, *Deutsche Literaturzeitung*, 1489-91, 1927.

Martin, William. Histoire de la Suisse, essai sur la formation d'une confédération d'états. 319 p. Paris, PAYOT, 1927. ISIS

(**Poole, Reginald Lane**). Essays in history presented to REGINALD LANE POOLE. XIV + 486 p., 4 pl. Oxford University Press, American Branch, New York, 1927 (s 7). ISIS

Essays dedicated to the late curator of the Bodleian Library, Oxford, on the occasion of his 70th birthday. Some of the essays are mentioned in the present bibliography. It includes a beautiful portrait and a bibliography of his own writings (1876-1926). G. S.

45. — HISTORY of ART.

(Art and science, Iconography, Arts and crafts).

Briggs, Martin Shaw. The architect in history. Oxford, University Press, 1927. ISIS

Hoever, Otto. An encyclopedia of ironwork. Examples of hand-wrought ironwork from the Middle Ages to the end of the eighteenth century. With an historical introduction. New York, E. WEYHE, 1927. ISIS

Pijoan, José. History of art. Translated by RALPH L. ROYS, with foreword by ROBERT B. HARSHE. Volumes I and II. New York and London, HARPER, 1927. ISIS

46. — HISTORY of LANGUAGE, WRITING and LITERATURE.

Dauzat, Albert. Les noms de lieux, origine et évolution; villes et villages — pays — cours d'eau — montagnes — lieux-dits. VIII + 264 p., illus. Paris, DELAGRAVE, 1926. ISIS

Fitzmaurice-Kelly, James. (1858-1923) A new history of Spanish literature. XVI + 551 p. Oxford, University Press, 1926. ISIS

Reviewed by E. WINKLER in *Deutsche Literaturzeitung*, 909, 1927.

Fitzmaurice-Kelly, James. Spanish bibliography. 389 p. For the Hispanic Society of America. London, MILFORD, 1925. ISIS

Guignon, J. (abbé). L'état actuel du problème d'une langue auxiliaire internationale. *C. R. Acad. des sc. mor. et politiques*, oct.-déc. 1926, 381-399. ISIS

Comparaison entre les différents systèmes proposés, et conclusion en faveur de l'ido. Cette communication de l'abbé GUIGNON est suivie d'observations présentées par CHARLES LYON-CAEN et ANDRÉ LALANDE (p. 400-404). L.G.

Hermannsson, Halldór. Catalogue of the Icelandic collection bequeathed by WILLARD FISKE. (Cornell University Library.) Additions, 1913-1926. IX + 284 p. Ithaca, N. Y., Cornell University, 1927. ISIS

Jónsson, Snaebjörn. A primer of modern Icelandic. VIII + 282 p. Oxford, University Press, 1927. ISIS

Includes readings (p. 123-91) and glossaries (p. 192-282). G. S.

Schmidt, Wilhelm (1868-). Die Sprachfamilien und Sprachenkreise der Erde. (*Kulturgeschichtliche Bibliothek*, herausgegeben von

W. Foy. Reihe 1 : Ethnologische Bibliothek, Band 5). XVI + 596 p. Altas of 14 maps. Heidelberg, C. Winter, 1926. ISIS

Reviewed in *Nature*, 120, 288-290, 1927.

47. — HISTORY of MORALS.

(*Moral organization of society*).

Sneath, Elias Hershey. The evolution of ethics. As revealed in the great religions. VIII + 370 p. New Haven, Yale University Press, 1927. ISIS

Souriau, Michel. La fonction pratique de la finalité. *Thèse*. Paris 264 p. Bibl. de philos. contempor., Alcan, 1925. ISIS

« Nous cherchons une règle ou un ensemble de règles propres à diriger notre conduite;... c est-à-dire telles qu'il vaille mieux les suivre que non pas » Cette recherche, poursuivie à travers Maine de Biran (la morale et le moi), Kant (la morale et la raison), Renouvier (la morale et la passion), et finalement à travers les données de la psychologie, arrive à cette conclusion : « Il faut m'efforcer en dehors de toute prévention, d'être profondément chrétien. »

L. G.

48. — HISTORY of PHILOSOPHY.

(*See also above* 18. *Philosophy of Science*.)

Cuvillier, A. Manuel de philosophie (classes de philosophie et de première supérieure). Tome II. Logique — morale — philosophie générale. (Cours de philosophie à l'usage des classes de philosophie et de mathématiques et des classes préparatoires aux grandes écoles). 681 p., 83 fig., 6 tables. Paris Armand Colin, 1927. (32 frs.) ISIS

Ce manuel parait fort bien renseigné, et la méthode en est intéressante. « On y a cherché à rendre la philosophie attrayante, tant par la clarté de la disposition typographique, par la richesse et l'intérêt des gravures qui accompagnent le texte — c'est, croyons-nous, le premier manuel de philosophie qui soit illustré — que par la forme concrète et vivante donnée à l'exposé de ces problèmes un peu ardus. Toutefois, à l'agrément de la présentation, on s'est efforcé de ne rien sacrifier de la solidité du fond. Tout au contraire, l'ouvrage se recommande par le sérieux de la documentation, la précision du développement, l'abondance des références. Il est au courant des plus récents progrès de la philosophie des sciences et de la métaphysique. Les questions morales s'y trouvent renouvelées par l'utilisation des derniers travaux accomplis en sociologie. Des exercices nombreux et variés en font un véritable Manuel, c'est-à-dire un instrument de travail qui fait, à chaque instant, appel à la collaboration active de l'étudiant. Enfin — autre innovation — des tableaux synchroniques permettent de se rendre compte de la filiation des doctrines et de leurs rapports avec l'ensemble du développement de la pensée et de l'activité humaines. » Le Tome I : Introduction générale et Psychologie, paraitra en 1928.

G. S.

Cuvillier, A. Cours de philosophie à l'usage des classes de philosophie et de mathématiques et des classes préparatoires aux grandes écoles, IV. Petit vocabulaire de la langue philosophique. 109 p. Paris, ARMAND COLIN, 1925. ISIS

Driesch, Hans. Mind and body. Translated by THEODORE BESTERMAN. London, METHUEN, 1927. ISIS

Third German edition 1923 : *Isis* 6, 234.

Heinemann, Isaak. Die Lehre von der Zweckbestimmung des Menschen im griechisch-römischen Altertum und im jüdischen Mittelalter. 102 p. Breslau, M. & H. MARCUS, 1926. ISIS

Reviewed by JULIUS GUTTMANN, *Deutsche Literaturzeitung*, 1848-50, 1927.

Rutot, A. et **Schaerer, Maurice.** La formation de la matière minérale. Cohésion, gravitation universelle, affinité, catalyse. 19 p. Bruxelles, H. WELLENS, 1927. ISIS

49. — HISTORY of RELIGION.

(*Religion and Science*).

Beth, Karl. Religion und Magie : ein religionsgeschichtlicher Beitrag zur psychologische Grundlegung der religiösen Prinzipienlehre. Zweite, umgearbeitete Auflage. XII + 433 p. Leipzig, B. G. TEUBNER, 1927. ISIS

First edition under slightly different title, 1914.

Bourdillon, Anne Francis Claudine. The Order of Minoresses in England. (*British Society of Franciscan Studies*, volume 12). VIII + 107 p. Manchester, University Press, 1926. ISIS

Macpherson, Hector Copland. The church and science : a study of the inter-relation of theological and scientific thought. (*The Living Church Series*). 254 p. London, JAMES CLARKE, 1927. ISIS

Maycock, A. L. The Inquisition from its establishment to the great schism. With an introduction by Father RONALD KNOX. Plates. London, CONSTABLE, 1927. ISIS

Millikan, Robert Andrews. Evolution in science and religion. (Published on the Dwight Harrington Terry Foundation). V + 95 p. New Haven, Yale University Press, 1927. ISIS

Reviewed in *Nature*, 120, 435-436, 1927.

Pallis, Svend Aage. Mandaean studies. Oxford, University Press, 1927. ISIS

Original Danish edition, Copenhagen, 1919.

Shipley, Maynard. The war on modern science : a short history of the fundamentalist attacks on evolution and modernism. XIV + 415 p. London, KNOPF, 1927. ISIS

VII. MEDICINE.

50. — HISTORY, ORGANIZATION, and PHILOSOPHY of MEDICINE.

Baglioni, Silvestro. I medici stranieri nella storia della medicina italiana. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, 116-119, 1926.

Baur, Marguerite-Louise. Recherches sur l'histoire de l'anesthésie avant 1846. *Inaugural Dissertation* zur Erlangung der Doktorwürde der medizinischen Fakultät der Universität Zürich, *Janus* 31, 89 p., 1927. ISIS

Dana, Charles L. Peaks of medical history : an outline of the evolution of medicine for the use of medical students and practitioners. 105 p., 40 pl., 16 illus. New York, PAUL B. HOEBER, 1926. ($ 3). ISIS

Nicely printed outline, with extravagance in illustration, of medical history. Six « peaks » are noted : HIPPOCRATES, The Alexandrians, GALEN, The Renaissance Period, HARVEY, and JENNER. C. D. L.

Delprat, C. C. De geschiedenis der nederlandsche geneeskundige tijdschriften van 1680 tot 1857. III. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 417-90, 1927. ISIS

Last article of this series, concluding with a chronological list of the 83 Dutch medical journals dealt with. Elaborate study with abundant facsimiles. G. S.

Diller, Theodore. Pioneer Medicine in Western Pennsylvania. XIV + 230 pp. 26 full-page illustrations. New York, PAUL B. HOEBER, Inc., 1927. ($ 3.00) ISIS

An important contribution to the history of American science. It deals with the history of medicine in Pennsylvania, West of the Allegheny Mountains, from the middle of the XVIIIth century to the middle of the XIXth century, and more briefly with subsequent developments down to our days. The early history is closely bound up with military history, for nearly all of the early medical men were military men. Parts of this book have already been quoted in *Isis* as they appeared in the *Annals of Medical History*. G. S.

Liek, Erwin. Der Arzt und seine Sendung; Gedanken eines Ketzers. 2. Aufl. 132 p. München, LEHMANN, 1926. ISIS

Loeb, Leo. Some considerations on certain relations between the history of medicine and general history. *Medical Life*, 34, 168-176, 1927. ISIS

Martin, Alfred. Historical sketch of balneology. *Medical Life*, 34, 256-300, 1927. ISIS

Twenty-three illustrations and short bibliography.

(Medicine, history. Congress.) VIe Congrès international d'histoire de la médecine. Catalogue d'une collection d'art medico-historique. Tableaux, portraits, dessins, manuscrits, livres rares et précieux, sculptures, médailles. Exposée, à l'occasion du VIe Congrès international d'histoire de la médecine au Musée Municipal d'Amsterdam. 21 Juillet-1 Août 1927. 123 p., many illustrations, 1927. ISIS

Exposition organisée par B. W. TH. NUYENS, F. M. G. DE FEYFER, I. VAN DER HOEVEN, « exclusivement composée d'œuvres d'artistes hollandais et de livres d'auteurs néerlandais ou imprimés dans les Pays-Bas, provenant de collections nationales. » G. S.

Opuscula selecta Neerlandicorum de arte medica. Fasciculus sextus quem curatores miscellaneorum quae vocantur Nederlandsch Tijdschrift voor Geneeskunde collegerunt et ediderunt. XV + 352 p. Amsterdam 1927. ISIS

The fifth volume of this admirable publication was analyzed in *Isis*, 10, 304. The present volume contains treatises or addresses by FRANCISCUS DE LE BOË (SYLVIUS), JAN SWAMMERDAM, REGNER DE GRAAF and SCHROEDER VAN DER KOLK. Each work is printed in Dutch and in Latin (or English). Brief analyses will be found in this bibliography in the following sections : XVII(2) C, XVII(2) D, XIX(1) D. G. S.

Ribbius, P. Medici en medische toestanden te Arnhem door alle tijden. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 532-557, 1927. ISIS

Sembianti, Pietro. Appunti di storia medica trentina e dell' Alto Adige. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, 157-162, 1926. ISIS

Sigerist, H. E. Die Geschichte der Medizin im Rahmen der Universitas litterarum. Sonderabdruck aus *Praemedicus*, 10 p. Leipzig, 1927. ISIS

Sigerist, Henry E. Die historische Entwicklung des Entzündungs-

begriffes. Leyden-Vorlesung im Berliner Verein für Innere Medizin und Kinderheilkunde, gehalten am 7. VI, 1926. Reprinted from *Deutsche Medizinische Wochenschrift*, Nr. 9, 10 p., 1927. ISIS

Simon, S. William. The influence of the three MONROS on the practice of medicine and surgery. *Annals of Medical History*, 9, 244-266, 1927. ISIS

Stern, Bernhard Joseph. Social factors in medical progress. (*Studies in History, Economics, and Public Law*, edited by the Faculty of Political Science of Columbia University, no. 287). 137 p. New York, Columbia University Press, 1927. ISIS

Reviewed by F. H. GARRISON, *American Historical Review*, 33, 90-91, 1927.

Sudhoff, Karl. Civilization and health. A historical colloquy. *Medical Life*, 34, 159-164, 1927. ISIS

Veth, Cornelis. De arts in de caricatuur. Met een inleiding van Prof G. VAN RIJNBERK. Amsterdam, Munster's Uitgevers-Maatschappij. ISIS

Reviewed by J. G. DE LINT, *Bijdragen tot de geschiedenis der geneeskunde*, 7, 410-411, 1927.

Wehrli, G. A. Die Bader, Barbiere und Wandärzte im alten Zürich. *Mitt. der Antiquarischen Gesellschaft in Zürich*, Bd. 30, Heft 3, 91 Neujahrsblatt. 100 p., 4 pl., 44 text fig. Zürich, 1927. ISIS

Reviewed by K. SUDHOFF, *Mitt. zur Geschichte der Medizin*, 26, 200-201, 1927.

The Wellcome historical medical Museum, 120 p., 16 pl., fig. The Wellcome Foundation Ltd., London, 1927. ISIS

Le Wellcome historical medical Museum (54 a, Wigmore str., London), fondé par HENRY S. WELLCOME, inauguré le 24 juin 1913 (*Isis*, 1, 572; v. aussi 2, 304), et qui avait été fermé pendant près d'un an pour une réorganisation complète nécessitée par l'accroissement des collections, a rouvert ses portes le 14 octobre 1926 (H. S. WELLCOME, directeur; L. W. G. MALCOLM, conservateur) comme organisation permanente. Aux documents d'anatomie, physiologie, chimie, pathologie, pharmacologie, orthopédie, obstétrique, psychiatrie, dentisterie, aux pièces de la statuaire, aux portraits, se sont ajoutés de nombreux souvenirs de LISTER, de JENNER, une section de la guerre; sa bibliothèque renferme actuellement plus de 100.000 livres, manuscrits et incunables. — le catalogue luxueux, richement illustré, qui présente ces collections renferme les discours prononcés en 1913 et en 1926.

A l'occasion du centenaire de la naissance de LISTER (5 avril 1827) est organisée une exposition spéciale d'objets présentant un intérêt scientifique, médical, ou simplement un intérêt personnel, touchant la vie et l'œuvre de

LISTER, et les périodes pré-listerienne et post-listerienne. Un très beau catalogue, avec nombreuses planches et portraits, a été édité à cette occasion sous le titre « Lister centenary Exhibition at the Wellcome historical medical Museum », 218 pp. Le catalogue proprement dit est précédé d'une étude de Sir HECTOR C. CAMERON : A short account on the evolution of LISTER's system of antiseptic surgery », une étude sur la vie, les recherches expérimentales, et l'influence de LISTER. On a aussi joint au catalogue la bibliographie des travaux de LISTER, et celle des principales notices qui lui ont été consacrées.

L. G.

51. — EPIDEMIOLOGY, HISTORY of SPECIAL DISEASES PUBLIC HEALTH and SOCIAL MEDICINE.

Andel, M. A. van. De scheurbuik als nederlandsche volksziekte. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 519-531, 1927. ISIS

Scorbut, a disease common in Holland.

Bishop, Louis Faugeres; Neilson, John, Jr. History of cardiology. Introduction by VICTOR ROBINSON. New York, *Medical Life Press*, 1927. ISIS

Kockel, Heinz. Lupus in fabula. *Archiv für Geschichte der Medizin*, 19, 349-350, 1927. ISIS

Menetrier, P. La fréquence réelle du cancer à Paris il y a cent ans était la même qu'aujourd'hui. *Bul. acad. de médecine*, 177-182, 23 févr. 1926. ISIS

Cette opinion de MENETRIER est appuyée sur les renseignements fournis par GASPARD LAURENT BAYLE (1774, 08, 18 — 1816, 05, 11) dans son Traité des maladies cancéreuses, ouvrage posthume dont la 1e partie parut en 1833, la seconde en 1839, et qui passa inaperçu. L. G.

Meyerhof, Max. Neues zur Geschichte des Begriffes Pannus. *Archiv für Geschichte der Medizin*, 19, 240-252, 1927. ISIS

« Mein Schluss geht also dahin, dasz die Griechen bereits den Hornhautpannus bzw. die Keratitis pannosa unter dem Namen *κιρσοφθαλμία* (variköse Augenentzündung) gekannt haben, und ebenso die Umschneidung der Pannusgefässe, vermutlich unter dem Namen *ἀγγειολογία*, den HIRSCHBERG bei PAULOS nachgewiesen hat. Den Arabern hat ein ganz entsprechendes Wort für die variköse Augenentzündung gefehlt, und sie haben daher das Wort sabal (Hineinfliessen in Gefässe bis zu strotzender Füllung) eingesetzt, während sie für die Operation das gut entsprechende Wort laqṭ (Zusammenlesen, Aufsammeln der Gefässe) angewandt haben. »

Newsholme, Sir Arthur. Evolution of preventive medicine. XV + 226 p., 7 pl. Baltimore, WILLIAMS & WILKINS, 1927. ISIS

Oudemans, A. C. Iets over de geschiedenis omtrent scabies en de acarus siro. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 369-375, 1927. ISIS

Sigerist, Henry E. Sebastian-Apollo. *Archiv für Geschichte der Medizin*, 19, 301-317, 2 Textabb., 7 Taf., 1927. ISIS

« Die beiden grossen Pestpandemien, die die Geschichte kennt, umrahmen das Mittelalter. Sie sind ihm Anfang und Ende. Aus der grossen Not des 6. Jahrhunderts ist SEBASTIAN erstanden. Unter seinen Schutz hat sich die christliche Welt begeben und er hat sie beschützt, hat sie vor der Seuche bewahrt während vielen Jahrhunderten, ihr die Ruhe gegeben, ihre Sendung zu erfüllen.

Als im 14. Jahrhundert das Mittelalter zu Ende ging, die Welt wiederum dem schwarzen Tod verfiel, SEBASTIANS Macht versagte, trat ein neuer Pestheiliger auf den Plan : ROCHUS.

Zu ihnen beiden, ROCHUS und SEBASTIAN, wandte sich das Volk in Zeiten der Not. Gemeinsam wurden sie vielerorts verehrt. Doch wie ungleich das Paar : ROCHUS, der biedere Wanderer, den schweren Mantel umgehängt, den Pilgerstab in der Hand, auf seine Pestbeule deutend. Und neben ihm SEBASTIAN, die Glieder frei, strahlend in jugendlicher Schönheit : APOLLO. »

Sommerlad, Georg. Geschichte der Hämophilie. *Diss.* aus der Leipziger chirurg. Klinik. 55 S. Leipzig, 1927. ISIS

Temkin, Oswei. Zur Geschichte von « Moral und Syphilis ». *Archiv für Geschichte der Medizin*, 19, 331-348, 1927. ISIS

Weyde, A. J. van der. Bijdrage tot de geschiedenis der pest te Utrecht. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 384-404, 1927. ISIS

52. — HISTORY of HOSPITALS and MEDICAL TEACHING.

Hellinga, G. Gasthuistoestanden in den « Goeden ouden tijd ». *Bijdragen tot de geschiedenis der genneeskunde*, 7, 501-512, 1927. ISIS

Napjus, J. W. De geneeskundige faculteit van de hoogeschool en rijksathenaeum te Franeker, 1585-1843. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 577-601, 1927. ISIS

53. — PHARMACY, PHARMACOLOGY, TOXICOLOGY.

Bouvet, M. La thérapeutique d'autrefois : l'aigle, le moineau, l'oie, les œufs. *Paris Médical*, 16e année, 129-133, 162-167, 1926. ISIS

Chacune des parties des oiseaux : cerveaux, fiel, fiente, graisse, langue, pattes, plumes, coquilles, membrane coquillère, blanc et jaune d'œuf, est étudiée au point de vue de ses propriétés thérapeutiques prouvées ou non,

depuis l'antiquité jusqu'au XIX^e siècle. L'auteur s'appuie pour cette étude rapide sur une bibliographie abondante et précieuse (plus de cent notes).
L. L.

Netolitzky, Fritz. Vom Asphalt über die Mumie zum Ichthyol. *Pharmazeutische Zentralhalle* 68, Nr. 4, 1927. ISIS

VIII. EDUCATION.

(the methods of accumulating, imparting and diffusing knowledge.)

57. — MUSEOLOGY.

(*Museums and Collections*).

Kenyon, Sir **Frederic George.** Museums and national life : the Romanes Lecture delivered in the Sheldonian Theatre, 17 June 1927. 32 p. Oxford, Clarendon Press, 1927. ISIS

Pessler, Wilhelm. Das Heimat-Museum im deutschen Sprachgebiet als Spiegel deutscher Kultur.Veröffentlichung des Werkbundes für Deutsche Volkstums- und Rassenforschung. 158 p., 94 illustrations. München, J. F. LEHMANN, 1927. ISIS

Reviewed by OTTO LAUFFER in *Deutsche Literaturzeitung*, 971-972, 1927.

59. — ERRATA and ADDENDA no. 15.

(*For previous errata see* Isis, 10, 311).

ISIS.

Vol. VII, 302. last note. MORI, ATTILIO (not Morri).
567. IORGA, NICOLAE (not Nicolas).
Vol. VIII, 215. GRAFTON ELLIOT SMITH (not G. G.).
741. Second BIRKENMAJER note, l. 2, 307 (instead of 30).
Vol. IX, 138. CLARK WISSLER (without comma).
376, line 12 from bottom. art (instead of representation) of nature.

SARTON'S INTRODUCTION.

Vol. I, (a) 57, line 20. PAUL MAZON (not Maron).
97, line 5. except (not expecting).

(a) From HOMER to OMAR KHAYYAM. XII+840 p. (Baltimore, WILLIAMS and WILKINS; London, BAILLIÈRE, TINDALL and COX, 1927.)

346. Christian monasticism, line 6. For the Essenes, see article by KAUFMANN KOHLER in Jewish Encyclopedia (vol. 5, 224-232, 1903).

418, line 18. Code (instead of Constitution).

680, footnote c. On the Khazars, see article Chazar by HERMAN ROSENTHAL in Jewish Encyclopedia, (vol. 4, 1-7, 1903).

The following corrections have been kindly suggested by Prof. DR. E. O. VON LIPPMANN (Many others are included in the present Critical Bibliography).

208. HERON : die « Schriften » stammen aus ganz verschiedenen Jahrhunderten, wo sich die Differenzen genügend erklären lassen (HOPPE).

213. CRATEVAS : das « Manuscript of DIOSCORIDES » ist auch jetzt noch in Wien. (I labored under the impression that it was one of the MSS. which Austria had been obliged to return to Italy by the Treaty of Peace).

460. Islam : eine gewaltsame Ausbreitung aus religiösen Gründen ist ganz unbewiesen.

745, 774. Chanson de Roland ist doch nicht z. B. dem Nibelungenlied überlegen.

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their copies of *Isis* and the *Introduction*. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note, thus to indicate that these and the previous errata have been taken into account. G. S.

These and previous errata have been corrected by.....

The corrections have been made in the card index by .....

Author's Index to the Twenty Third Bibliography.

The Roman figures refer to centuries; the Arabic figures, to the sections of Parts II and III, which are numbered consecutively from 1 to 59. This index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at glance what each writer is doing.

December 10, 1927. DOROTHY WATERMAN.

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